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ERRATA.

Medical Jurisprudence for India.

Page 514, second paragraph, 4th line, *delete from* "Occasionally" *to* "normal way (Hankin)" at end of the 15th line of this paragraph.

Page 515, *delete* "(Hankin)" at end of first paragraph after the word "copper."

Page 547, first line, *for* "water" *read* "half per cent. acetic acid."

Page 548, third line, *delete from* "(8) When" *to* "meconic test" at end of 14th line on page 549, inclusive, and, in place of this deletion *insert*:—

(8) When the ether has separated, tap off the watery layer into a second separating funnel in which three or four c.c. of chloroform have previously been placed.

(9) To the liquid in the second funnel add a small piece of litmus paper and about 40 c.c. of ether.

(10) Shake for a second or two. Add a few drops of ammonia. Instantly shake violently. See that the reaction is alkaline. Then shake for about half a minute. (Note.—Do not use a previously prepared mixture of ether and chloroform, as, if this is done, the liquids are less likely to separate properly than if the ether and chloroform are added separately).

(11) Fix the separating funnel, with its stopper out, in a stand till the liquids separate. If the liquids do not separate at once, add a few drops of alcohol and shake *gently*. If this does not cause separation, add more alcohol. In rare cases it may be necessary to add several cubic centimetres. Still more rarely it may be necessary to centrifuge to cause separation.

(12) Tap off the watery liquid and throw it away.

(13) Pour the ether-chloroform mixture, from the mouth of the funnel, into a basin. Add two or three c.c. of half per cent. acetic acid and evaporate off the ether and chloroform on a waterbath. The liquid that remains we may refer to as the "acetic residue."

(14) Put about half a c.c. of the acetic residue into a small porcelain basin. Add one drop of strong or concentrated hydrochloric acid. Heat over a flame till just boiling. If Indian opium is present, a rose-red colour develops. This reaction (the so-called "porphyroxin test") is not given by Turkish opium.

(15) If the red colour develops, this red liquid may be

P.T.O.

used for the Husemann reaction. While moving the basin to and fro at a little height above a flame, evaporate it down till only a drop or two is left.

(16) Then, after allowing it to cool slightly, add about 3 c.c. of concentrated sulphuric acid.

(17) Heat. If opium is present a violet colour may or may not develop. Go on heating till the liquid begins to give off fumes.

(18) Allow the basin to cool. Pour the contents into a second basin to hasten cooling.

(19) With a fine glass rod add a minute drop of concentrated nitric acid to the cooled liquid. If opium is present, a peculiar orange-brown colour develops in the area reached by the nitric acid. This area is apt to be bordered with purple, especially if the basin is gently rocked to and fro.

(20) Place in a porcelain basin about 3 c.c. of a three per cent. solution of urotropin in concentrated sulphuric acid. Add to it one drop of the acetic residue (of para. 13). Do not disturb the basin. If opium is present a violet colour gradually develops. But the presence of nitrates and certain other not identified impurities may prevent the development of the violet colour.

(To make the urotropin solution, the urotropin crystals should be finely powdered. They must be quite dry. The whole amount of sulphuric acid to be used should be added in one lot while stirring, as, if it is added gradually and without stirring, heating and charring is apt to occur.)

(21) Other portions of the acetic residue may be used in testing for other alkaloids.

By the method here described the use of amyl alcohol is avoided. It is a very troublesome substance to work with and its use is unnecessary.

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WITH ILLUSTRATIVE CASES.

BY

L. A. WADDELL,

C.B., C.I.E., LL.D., M.B., F.L.S.,

Lt.-Colonel, I.M.S. (Retd.), Ex-Professor of Chemistry, Calcutta Medical College; Chemical Examiner to Governments of Bengal and India, and Examiner in Medical Jurisprudence, Calcutta University.

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PREFACE TO THE SEVENTH EDITION.

In response to the demand for a further edition of this work, the Seventh,—a demand which is gratifying alike to the joint-author and the publishers, as attesting the felt want which the work fills as a standard text-book—opportunity has been taken to revise the text and to add fresh matter and illustrative cases wherever found necessary, to bring it up to date. The chapter on Blood-Stains has been revised by Colonel Sutherland, and further statistical evidence supplied of the practical value of his method for the detection of human blood.

It is hoped that these additions will enhance the usefulness of the book alike to Civil Surgeons, Medical Practitioners and Students, the Bench and the Bar in India.

L. A. WADDELL.

London,
March, 1921.

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INTRODUCTORY.

MEDICAL RELATIONS WITH THE LAW COURTS.

> "*As a hunter tracks a wounded beast to its lair by its drops of blood, so let a King track* [*crime*] *to justice by close-searched proofs.*"—MANU'S LAW CODE (about 100 B.C.).

MEDICAL Jurisprudence may be defined as the science which teaches us how to discover and apply medical and cognate scientific facts for the ends of Law and Justice, in unravelling Crime and protecting Individuals, Society and the State. It is an application of Medical Knowledge from a very different standpoint from Medicine proper; and represents all the difference between seeing by the eye of the Law, instead of by the eye of the Healing Art. Thus a wound which the surgeon is concerned only to so examine and treat as to heal it as quickly as possible, requires the medical jurist to note: 'Is it dangerous to life'? 'How and with what weapon was it inflicted'? 'Was it accidental, self-inflicted, suicidal or homicidal'? 'Was it inflicted before or after death'? etc., etc., etc. And in a case of cut-throat, whilst his first object is to save the patient's life, he requires to note many necessary details for the law-courts.

The early use of medical knowledge for legal purposes can be traced in the ancient codes. Manu forbade corporal punishment of a pregnant woman; the Mosaic Law, which is now found to have been borrowed by the Jews from the Babylonian Code of Khammurabi (2123–2081 B.C.) and previous Aryan lawgivers, required the priests to adduce medical evidence in wounds, leprosy, etc.; the Greek forensics, such as Galen, discussed questions of legitimacy, simulated diseases, the differences between the lungs of the live-born and the fœtus; and for India there are similar references in the later *Vedas*, in Manu's code and the *Purānas*. In Vedic literature (*circa*

650–100 B.C.) abortion or 'the slaying of an embryo' (*bhrūṇa-hatyā*) was a specified crime.[1]

It was not, however, until the 16th century A.D. that a definite status was accorded to medical evidence in European courts of law. The penal code of George, Bishop of Bamberg in Germany, drawn up in 1507, is considered the first effort in this direction, and a quarter of a century later this was enlarged and extended to the German empire by the Diet of the neighbouring town of Ratisbon. In 1553, Charles V. promulgated the code bearing his name—*Constitutio Criminalis Carolina*—which has been called "the dawn of legal medicine." In it the magistrate is directed to obtain the opinion of medical men in criminal trials where death was alleged to have occurred from criminal causes.

This new department of study was known as *State Medicine* in Germany, and as *Legal Medicine* in France, and when it was latterly introduced into Great Britain it was called *Medical Jurisprudence*, or *Forensic*[2] *Medicine*. The first systematic treatise on the subject in English appeared in 1787, in Dr. Parr's "Elements of Medical Jurisprudence," and in 1801 the first chair for the teaching of the subject was established in Britain, that of Dr. Duncan at Edinburgh.

Whilst the edifice of the new study was reared on the European continent, largely by the systematic labours of Orfila the Spaniard, of Tardieu in Paris, and of Casper in Berlin, before the year 1850 the classics of Christison of Edinburgh, and Taylor and Guy of London had redeemed the reputation of the British school, and soon thereafter India possessed Norman Chevers' pioneer manual. At the present day the importance of this subject is so well recognized that its study forms an essential part of the medical course of every university and licensing body in the United Kingdom. So also is it in India, for expert medical testimony, important in every country, is especially so in the East, where it is often the only trustworthy evidence on which hangs the liberty or the life of a human being.

In this way, the Law, in the interests of good government, often required medical men to assist it in laying bare the evidence of many kinds of crime and offences against the person and civil rights of individuals and the community at large, such as assault, murder, poisoning, rape, legitimacy, inheritance, divorce, insanity, fraudulent impersonation, questions of damages for injuries, life assurance, etc. Thus the medical

[1] *Vedic Index*, Macdonell and Keith, 1912, I. 391.

[2] 'Forensic' is derived from the Latin *forum*, the market-place, because the Romans, whose law code still remains to-day the basis of our own, held their court of justice there.

practitioner is liable to be called on at any time to give evidence as a medical jurist in the witness-box, in cases of more or less public interest or notoriety, so it behoves him even for his own reputation that he should learn to look from the medico-legal standpoint upon all his cases which are likely to become the subject of judicial inquiry; and that he should carefully note down at the time everything likely to be of medico-legal importance.

It is also desirable that he should know something of the legal nature of evidence and the procedure in courts of law; and in the case of the medical jurist in India, the procedure in Indian law courts in particular, some of the peculiarities of crime in India, the circumstances under which the more common crimes come to be perpetrated, and the devices ordinarily taken to conceal crime in this country.

Criminal Procedure and Medical Evidence in India.

The present law of India is based upon English and Roman law modified to suit the varying customs and religious beliefs of the Hindu, Mohammedan, and other different nationalities which make up the great Indian continent.

The preliminary inquiry into offences against the person and into sudden and unnatural deaths in India is made by a police-officer,[1] who is authorized in fatal cases to forward the dead body for examination to the nearest civil surgeon or other qualified medical man appointed by the Local Government to conduct such examinations, except in Calcutta and in Bombay city, where the coroner makes an inquest and arranges for the *post-mortem* examination. District, sub-divisional, and other magistrates specially empowered by the Local Government or by the district magistrate, may also hold inquests and order the exhumation of a body for examination.[2]

The medical officer's report is sent to the magistrate of the district (or his sub-divisional magistrate), who, in cases where a reasonable suspicion is established against an accused person in the case, may require the presence of the reporting medical officer to give a deposition at his court in presence of the accused and be cross-examined if necessary. For the medical report cannot be admitted as evidence until it has been deposed to and recorded *de novo* by the magistrate in presence of accused.

[1] *Criminal Procedure Code*, *s.* 174 (1). In Bombay and Madras Presidencies the inquiry into unnatural deaths may be made by the village headman (*s.* 174 (4)).

[2] *Cr. P. C. ss.* 174 (5), 176.

At this magistrate's court the medical officer should give his evidence with as much care as he would do in the High Court, for his evidence is recorded, and the case may go to the higher court however trivial it may seem, in which case the opposing counsel with the evidence in the lower court laid before him and with weeks to pick holes in any loose expressions that he may have used, and prompted by a clever medical man at his elbow, may bring the medical evidence into discredit. On the other hand, if the medical report does not substantiate the charge, the case is not usually proceeded with further; for the medical officer exercises practically the judicial function of a 'Court of First Instance' in assault cases.

Should it prove to be one of the more grave offences, such as murder, causing miscarriage, rape, etc., which are triable only by Courts of Session or High Courts, the district magistrate (or his sub-divisional magistrate) after recording the evidence commits the accused for trial to the higher court. Thus the medical man who conducted the original examination may be required to appear before more than one court in connection with the same case should the magistrate deem it necessary.[1]

The several **criminal courts** are: (*a*) High Courts; (*b*) Courts of Session; (*c*) Magistrates of the 1st class and Presidency Magistrates of the 2nd and 3rd class.

The **powers** of these courts are:—The High Courts and Courts of Session are empowered to try any offence and to pass any sentence authorized by law; but a sentence of death passed by a Court of Session shall be subject to confirmation by the High Court (*s.* 31). Courts of presidency magistrates and of magistrates of the first class may not try certain grave offences, *e.g.* murder, causing miscarriage, rape, and unnatural offences, and may not, for any single offence, sentence to more than two years' imprisonment and 1000 rupees fine. Magistrates of the second class may not try any offence punishable with three years' imprisonment (*s.* 29), and may not, for any single offence, sentence to more than six months' imprisonment and 200 rupees fine. Magistrates of the third class may not try an offence punishable with one year's imprisonment, and may not, for any single offence, sentence to imprisonment for more than one month and 50 rupees fine. Third class magistrates may not sentence to solitary confinement or to whipping, and second-class

[1] *Cr. P. C.*, *s.* 509 (1), states that if the civil surgeon's evidence is taken before the committing magistrate, and *attested* by him, that is to say, the committing magistrate must state below the civil surgeon's deposition that it was taken in presence of accused, and explained to him, and that he had an opportunity of cross-examination, the higher court may accept it as evidence without calling the civil surgeon. Clause 2, however, empowers the higher court to call him, but this is not usually done with provincial cases, unless the committing magistrate had omitted some important point. So where the attendance of a medical witness cannot be obtained, and his evidence is taken on commission under Chap. XL. of the *Cr. P. C.*, his depositions can be used at the trial (*s.* 509).

magistrates may only sentence to whipping, if specially empowered by the Local Government (*s.* 32).

A Jury is required in every criminal trial before a High Court. Juries are of two kinds, **Special** and **Common.** A special jury is composed of persons taken from a special list of about two hundred. In every case where the offence to be tried is punishable with death, and also in such other cases as a judge of the High Court may direct, the trial is to be before a special jury (*s.* 276). In all other cases the trial takes place before a common jury, *i.e.* composed of persons whose names appear in the general list of persons liable to serve as jurors.

Trials before a **Court of Session** are ordinarily conducted with the aid of assessors, two or more in number, but the Local Government can, by order in the official *Gazette*, direct trials before any Court of Session of all offences or any particular class of offences to be by jury. Section 320 of the Code enumerates the persons exempt from liability to serve as jurors or assessors, and clause (*h*) of this section includes among those exempted "surgeons and others who openly and constantly practise the medical profession."

When an accused person appears to be "of unsound mind, and consequently incapable of making his defence," the magistrate shall first inquire into or try the fact of such unsoundness of mind, and if this be proved the trial shall be postponed and the magistrates shall cause the accused to be examined by the civil surgeon, or such other medical officer as the Local Government directs.

Coroner's Court.—This is a preliminary court of inquiry, into the cause of all accidental and sudden deaths, where there is any suspicion of foul play. In India the Coroner is restricted to the presidency towns, for the provinces the district and other magistrates are ex-officio coroners, although seldom performing the duties, the inquiry being conducted by the police in correspondence with the civil surgeon; see above. The coroner views the body at his inquest with a jury. At this court no accused need be present as no one is being tried, unlike a magistrate's court which is a court of inquiry, not into the mere cause of death, but into the culpability of a person accused of some specific criminal act or negligence [1] of a criminal kind, and where the accused must be present, and where witnesses may be cross-examined, and the simple cases be dealt with summarily.

At the coroner's court, however, any 'suspected person' must be present if possible, and has the right of producing witnesses, cross-examining himself or by counsel, and of making any defence or statement he desires. When a suspected person is ill the inquest is adjourned till he is able to attend. The coroner's court also inquires into the culpability of a person

[1] Offence by 'illegal omission' (*Penal Code*, *s.* 32), *e.g.* a woman may be committed for murder by intentionally omitting to tie the cord, or to supply her infant with food (see chapter on 'Infanticide').

suspected, and returns a verdict specifying the offence of the suspected person, *e.g.* 'culpable homicide amounting to murder,' 'rash and negligent act,' etc. The coroner in India has the power to commit to the sessions direct.

In all cases of fatal accident and sudden and unexpected death under suspicious circumstances occurring in practice, the attending medical man should never grant a *death-certificate* when he cannot conscientiously certify the true cause of death, even should the family of the deceased press for a certificate to save the publicity of an inquest. It is his duty to report the matter to the police or the coroner direct; for afterwards if the magistrate or coroner be not satisfied that the death was from natural causes or simple accident they may have the body exhumed after burial, and if foul play be discovered make the medical man who wrongly certified an accessory to the crime. For instructions on the important question of *Death Certificates* see under that heading.

The Duties of a Coroner in India are thus defined: "Where a coroner has reason to believe that the death of any person has been caused by accident, homicide or suicide, or suddenly by means unknown, or that any person being a prisoner has died in prison and that the body is lying within the place for which the coroner has been appointed, the coroner shall inquire into the cause of death."—*The Coroner's Act* (Act IV. of 1871), *s.* 8. Other provisions are: That an inquest need not be held in a case where a prisoner has died in prison from cholera or epidemic disease.—*s.* 9. That the coroner may order a body to be exhumed.—*s.* 11. That the inquiry is to be conducted by the aid of a jury (of 5, 7, 9, 11, 13, or 15 in number) who, with the coroner, are to view the body.—*ss.* 12, 15. The coroner is empowered to order a *post mortem* examination with or without analysis of the viscera, to be made by any medical witness summoned to attend the inquest, and such medical witness, other than the chemical examiner to Government, shall be entitled to such reasonable remuneration as the coroner thinks fit.—*s.* 18. Evidence is to be given on oath (*s.* 19) reduced to writing by the coroner (*s.* 20), and the jury are to return a verdict (*s.* 23). A coroner may appoint a deputy coroner to act for him when sick, or absent from any lawful or reasonable cause.—*s.* 28.

Procedure in Courts.

To these courts the medical man is summoned to attend by a **subpoena,** a writ commanding attendance under a penalty. In civil cases it is necessary that a **fee,** termed 'conduct money,' should be offered on delivering the summons; if this be not done the medical man may, in civil cases, previous to being sworn, refuse to give evidence till any reasonable fee demanded has been paid. But it is chiefly with regard to criminal cases that the medical man has to give evidence, and he has no option

but to be sworn and examined irrespective of the question of fees.[1]

Fees in cross-examination in criminal cases.—In support of a rule obtained on behalf of Iswar Chunder Ranth, calling upon the district magistrate of Dacca to show cause why the conviction and sentence passed on the petitioner should not be set aside and the trial resumed on the ground that the petitioner was not allowed to cross-examine the medical witness in the case, except on payment of the usual costs and compensation. The petitioner was convicted by an honorary magistrate of Narayanganj of causing hurt and was sentenced to six months' rigorous imprisonment and to a fine of Rs. 100 or, in default, six weeks' additional imprisonment. Their lordships made the rule absolute, holding that the petitioner was entitled, under *s.* 350 of the *C.P.R.*, to cross-examine the witness without payment of costs or compensation (Calcutta High Court).—*Englishman*, 23rd January, 1900.

On being called into the witness-box before your evidence is taken you have to be **sworn**. It is well for obvious reasons in taking the oath not to kiss the book, but to claim to be sworn by the more sanitary Scotch form. For this hold up the right hand above your head, and say in a loud, firm tone: "I swear by Almighty God, as I shall answer to God at the last day of Judgment, that I will tell the truth, the whole truth, and nothing but the truth." Then your evidence will be taken.

Medical Evidence.

Every fact which is referred to in law must pass through the process of proof by testimony. How this testimony is elicited in India is detailed in the *Indian Evidence Act* (Act I. of 1872). Evidence is given in two forms: (1) documentary, or (2) oral.

Documentary evidence comprises all documents produced for the inspection of the court. For the medical jurist this comprises :—

1. **Certificates** of death, ill-health, insanity, vaccination, etc.—*Death certificates* must be given free of charge if the medical attendant knows the cause of death, even though his attendance fees have not been paid; he "must give a certificate

[1] When a medical officer, other than a civil surgeon or medical officer of any grade in the civil employment of Government, is called upon to make a *post mortem* examination, he should be paid a fee of Rs. 16 for the same. Should he be summoned to give evidence in the case in court, he is not entitled to any further remuneration beyond the ordinary travelling allowance of a witness. For a medico-legal examination, other than a *post mortem* examination, the fee is Rs. 10 on the same conditions.—[Government of India, No. 1370, dated 23rd June, 1869, and No. 3050, dated 11th August, 1882.]

to the best of his belief and knowledge," and "a reasonable excuse" must be given for withholding a certificate (see p. 98).

Medical certificates must now be signed by registered medical practitioners in Bengal and other provinces where the register has been instituted.[1]

2. **Medico-legal Reports.**—These are the formal reports of an examination made by a medical man under a warrant from a magistrate, coroner, or authorized police officer in cases of assault, murder, etc.

These reports (see Form in Appendix III.) should always be prepared with the utmost care; one of these may prove the death warrant of a murderer. The report should give (1) *Date* and *place* of examination and name of *witnesses;* (2) *External* examination (of living, pp. 31, 66, etc.; of dead, pp. 38, 74, etc.); (3) *Internal* examination in fatal cases (p. 95); (4) Reasoned opinion giving the inferences drawn; (5) Signature of reporter. All the times, dates, and numbers should be expressed in writing, and all articles submitted for examination should be labelled with a distinguishing number for reference, and the names noted of the officials or other persons from whom he received any articles, information, or who identified the person or body. Technical terms are to be carefully avoided unless their meaning is made clear.

The **opinion** based on the facts noted should be stated briefly and clearly, and given with the utmost caution (see pp. 71 and 98). For the apparent or alleged cause of injury or death is

[1] The Bengal Medical Act, 1914 (Bengal Act VI. of 1914) has since been brought into force, section 30 of which lays down that no certificate required to be given by any medical practitioner or medical officer under any Bengal Act or any Act of the Governor-General of India in Council in force in Bengal shall be valid, unless such practitioner or officer is registered under the Medical Acts or this Act. The Bengal Council of Medical Registration maintains under section 15 of the Act a Register of Medical Practitioners who are eligible under section 17 of the Act for such registration, and publishes annually, under section 32 of the Act, a list, entitled the "Annual Medical List," of the names for the time being entered in the Register of Registered Practitioners. The List of Qualified Medical Practitioners in Bengal has been replaced by this "Annual Medical List." In view of the provisions of section 30 of the Act, and as under section 25 of the Act, a registered practitioner, who gives a false certificate, is liable to have his name removed from the Register and consequently from the "Annual Medical List," the Governor in Council *now directs*, in modification of the orders contained in paragraph 2 of the Resolution of the 23rd July 1910 cited above *that medical certificates granted to non-gazetted officers of Government by registered Medical Practitioners whose names are borne on the aforesaid "Annual Medical List" shall be accepted without the countersignature of Civil or Presidency Surgeons as the case may be.* If, however, the authority concerned doubts the genuineness or veracity of any such certificate, he may institute an inquiry, the result of which shall be reported to the Bengal Council of Medical Registration.

not always the real one; thus in India it is a common practice to hang up the dead body of a person who has been murdered so as to create a suspicion of suicide (see 'Hanging' in Chap. VII.), and there may be fatal concussion of the brain from a blow which cannot be ascertained by a *post mortem* inspection or dissection, but only inferred from the history of the case. If the medical attendant or registrar makes use of the history of the case, as supplied to him by the police or others, he should be careful to state this explicitly in his 'opinion,' *e.g.* "From the history of the case, and from the *post mortem* appearance, I am of opinion that the deceased died from shock caused by a blow"; and where the opinion cannot be given until after the result of chemical analysis of the viscera is known, this should be stated accordingly.

Both of the above classes of documents require to be sworn to orally as true by the person who drew them up, in the more serious cases; but the following documentary evidence is accepted *without* oral evidence in court: (1) Dying declarations, (2) Expert opinion from books.

1. Dying Declaration.

Statements, written or verbal, made by a person who is dead, as to the cause of his death or as to any of the circumstances of the transaction which resulted in his death, are admissible in cases where the cause of that person's death comes into question, no matter whether the person making such statement was or was not under expectation of death at the time of making it.—[*I. E. A.*, *s.* 32, and *Cr. P. C.*, *s.* 164.] If an injured person is likely to succumb, the doctor, failing the police, should arrange for the declaration to be made properly in the presence of a magistrate if possible, failing whom he may record the declaration himself.

The declaration should, if possible, be written by the person making it, otherwise it must be taken down in the identical words uttered by the dying man in his own vernacular, and nothing suggested or added. It should be read over to him and then, if possible, signed by him and attested by the writer, and any witnesses present. It should then be forwarded in a sealed envelope direct to the magistrate who would ordinarily inquire into the case.

At outlying dispensaries.—The hospital assistant in charge should at once call on the Sub-Deputy Collector or Tahsíldár, or in his absence or when he has no magisterial power, the nearest honorary magistrate, to record the dying declarations

of such persons as are likely to die and are in a fit state to make a statement. If there is, in his opinion, no time to call on the Tahsíldár or an honorary magistrate, he may record the dying declaration himself.

The State of Mind of the declarant at the time when he made his declaration is of great importance.

It may here be noted that according to the law of England, the person making a dying declaration must not only be actually moribund, but must have no hope of recovery and believe recovery impossible.

2. Printed opinions of experts.

Expert opinion expressed in any treatise commonly offered for sale, and the grounds upon which such opinions are held, may be proved by the production of such treatises, if the author is dead, or cannot be found, or has become incapable of giving evidence, or cannot be called as a witness without an amount of delay or expense which the court regards as unreasonable.—*I. E. A., s.* 60.

Case.—An European, in a drinking bout at Calcutta, was found in his room, bleeding from a wound on the back of the head. A police-officer inquired, "How did this happen?" He replied, "She (his wife) threw a glass at me." The wife said, "Don't say that; you know I did not do it; he has fallen out of bed on a cup." The man was drunk, and never spoke rationally up to the time of his death, three hours after. Portions of the enamel of a tea-cup (bloody fragments of which were found scattered about the room) were removed from the wound before death, and some minute flakes of the enamel had been driven under the pericranium. At the *post mortem* examination traumatic extravasation of blood on the brain was found, attributed to *contre-coup*, and the universal medical opinion was that the wife's statement was the true one, and that when the man accused her he was not mentally in a condition to know how the injury had been inflicted. A fall upon a tea-cup could produce the appearances described, whereas the power of a woman's arm would be insufficient to throw a tea-cup with such strength as to force the enamel under the pericranium. The wife was acquitted.—Chevers, *Manual Ind. Jurisp.*, 93.

In the case of a **will by a dying man**, if no magistrate can be obtained, the medical attendant may record it, in which case the attestation clause should not be forgotten, and care should be taken that its conditions are strictly complied with:—"Signed by the testator A B, in the presence of us (there must always be two witnesses), present at the same time, who at his request, in his sight and presence, and in the presence of each other, have attested and subscribed the same." All alterations must be initialled by both testator and witness, as well as each page, and the foot or end should be signed by the testator or by some other person in his presence and by his direction. The testator must be conscious at the time when the witnesses attach their signature.

3. **Evidence given** in a previous judicial proceeding by a witness who is dead, or cannot be found, or is incapable of giving evidence, or is kept out of the way by the adverse party, or whose attendance cannot be obtained without an amount of delay or expense which the court, under the circumstances of the case, considers unreasonable, is admissible under certain conditions (*s.* 33). Under this rule the deposition on oath of a dying person, taken by a magistrate in presence of the accused, becomes admissible in place of a dying declaration, and when the circumstances of the case permit, it is always advisable to take steps to obtain such a deposition.

4. **Deposition** of a civil surgeon or other medical witness, taken and attested by a magistrate in the presence of the accused, may be given in evidence in an inquiry or trial or other proceeding under the Code of Criminal Procedure, although the deponent is not called as a witness, but the court may, if it thinks fit, summon and examine the deponent.—*Cr. P. C.*, *s.* 509.

5. **Any Document** purporting to be a report under the hand of any chemical examiner or assistant chemical examiner to Government, upon any matter or thing duly submitted to him for examination, or analysis and report, in the course of any proceeding under the Code of Criminal Procedure, may be used as evidence in any inquiry, trial, or other proceeding under the said Code.—*C. P. C.*, *s.* 510.

Oral evidence must in all cases be direct, *i.e.* if it refers to a fact which could be seen, heard, or perceived in any other manner, it must be the evidence of a witness who says he saw, heard, or so perceived it; if it refers to an opinion, or the grounds on which that opinion is held, it must be the evidence of the person who holds that opinion on those grounds, and not mere hearsay.[1] Oral evidence is the more important of the two, as it admits of cross-questioning, so that the giver of documentary evidence is subject to be summoned for oral examination. If oral evidence refers to the existence or condition of any material thing, the court may require the production of such a thing for its inspection, viz. a blood-stained weapon, or article of clothing, a portion of eliminated poison, etc., etc. Hence such article should, always after examination, be preserved, if possible, for production before the court. '*Circumstantial*' evidence attests one of the subsidiary circumstances of the case, *e.g.* in case of an alleged stabbing of A by B on a river-bank at 4 o'clock on a particular day, circumstantial evidence would be that I saw B with a knife in his hand at ten minutes to four on that day near that place.

Witnesses.

Evidence is of two kinds, namely, (1) '**Common,**' or testimony to facts which the ordinary witness has actually observed

[1] *I. E. A.*, *s.* 60.

himself, and (2) **'Expert,'** or interpretation by expert persons or specialists of the facts observed by others, or of recondite observations by themselves. The medical witness usually gives evidence of both kinds, but in nearly nine cases out of ten as an expert. A **'Skilled'** or **'Scientific'** witness is a rather loosely applied term to mean a person of specialized knowledge of some technical subject and who may be an 'expert,' but who usually has no firsthand knowledge of the particular case. A **'Hostile'** witness is one who is assumed to have an interest or motive in concealing part of the truth or in giving positively false evidence.

1. A **'common'** witness testifies to the facts. "Fact," as defined by the Indian Evidence Act, "means and includes (1) any thing, state of things, or relation of things capable of being perceived by the senses; (2) any mental condition of which any person is conscious." The medical man is a common witness when he testifies to the exact size and number of wounds, blood-stains, etc., of a wounded person he has examined, the exact weight of solids and volumes of fluids he refers to, the circumstances under which he found the body, any statement or confession made by the dying person, the actual cause of death, etc.

All persons are competent to testify, unless the court considers that they are prevented from understanding the questions put to them, or from giving rational answers to those questions, by tender years, extreme old age, disease, whether of body or mind, or any other cause of the same kind (*I. E. A.*, *s.* 118). In certain special cases (*ib.*, *ss.* 121–129) a witness may, on certain grounds, claim exemption from being compelled to answer certain questions, *e.g.* "no public officer shall be compelled to disclose communications made to him in official confidence when he considers that the public interests would suffer by the disclosure" (*ib.*, *s.* 124). A witness is not exempted from answering questions on the ground that his answers would tend to criminate himself, but, if compelled to answer, his answers cannot be used as evidence against him (*ib.*, *s.* 132). In addition to the checks on untruthfulness of a witness afforded by the provisions of the Penal Code relating to the giving of false evidence (*ss.* 191–195), and the publicity of judicial proceedings, there is the most effective one of requiring evidence to be given *viva voce*, in presence of the party against whom the evidence is produced, who has the opportunity of cross-examining the witness.

2. An **'expert'** witness.—This is defined[1] to be a person "specially skilled in foreign law, science or art, or in questions as to identity of hand-writing or finger-impressions."

Examples of expert evidence.—(*a*) "The question is whether the death of A was caused by poison. The opinions of experts as to the symptoms produced by the poison by which A is supposed to have died

[1] *I. E. A.*, *s.* 45.

are relevant. (*b*) The question is whether A, at the time of doing a certain act, was, by reason of unsoundness of mind, incapable of knowing the nature of the act, or that he was doing what was either wrong or contrary to law. The opinion of experts upon the question whether the symptoms exhibited by A commonly show unsoundness of mind, and whether such unsoundness of mind usually renders persons incapable of knowing the nature of the acts which they do, or of knowing that what they do is either wrong or contrary to law are relevant." —*I.E. A.*, *s.* 45.

Medical experts are skilled in such special branches as toxicology, obstetrics, insanity, etc., and also in the interpretation of wounds, etc., and when the medical witness is called on to answer questions of opinion either on the facts observed by himself or others, he becomes an expert witness, whilst the ordinary expert witness usually is asked merely for his opinion on certain facts of the case, and acts as an interpreter of facts without having personal knowledge of them. Previous personal knowledge of the facts of a case precludes a witness from taking any possible advantage of the *status* of an expert[1] as regards compulsory attendance at court, etc.

Case.—A medical man who has not seen a corpse which has been subjected to a *post mortem* examination, and who is called to corroborate the opinion of the medical man who made the examination and gave his opinion as to the cause of death is in the position of an expert.—*Queen Empress* v. *Meher Ali Mullick*, 15 Cal. 589.

The medical witness therefore must bear in mind this distinction between 'common' and 'expert' witnesses, and when stating facts of his observation, avoid giving opinions or inferences on these facts until asked to do so. It is, however, as an expert that he is mostly examined, and then it is a decision rather than evidence which the law demands of him when replying to such questions even in regard to facts observed by himself as:—Is this wound dangerous to life? Was the wound accidental, suicidal, or homicidal? Was it inflicted before or after death? With what kind of weapon was it inflicted? In answering such questions he should be careful to draw no stronger inference than the facts warrant, and when the facts do not warrant a decided opinion either way, he should state his reasons for being unable to give a definite opinion on the point. Experts may refresh their memory by referring to professional treatises.[2] The apparently contradictory character of expert evidence sometimes is largely owing to the partisan manner in which it is elicited. The expert is often a party witness, each side being permitted to employ expert witnesses, and they are asked by their side to answer questions on the assumed facts which are most favourable to their side. Then

[1] Manu, p. 9.

[2] *I. E. A.*, *s.* 159.

in cross-examination the expert has to answer fresh hypothetical questions based on an altogether different combination of the assumed facts with the view of contradicting the original evidence.

Examination.

Your oral evidence is taken in the following order:—[1]

1. **Examination-in-chief.**—This is a series of questions put to you by the counsel for the side on which you appear, with the object of placing before the court in a clear manner all the principal facts you know that bear upon the case in point. He knows from his '*brief*' the nature of your evidence, and is not allowed to put 'leading' questions. A '**leading** question' is one to which the answer is suggested by the tone and form of the question.

2. **Cross-examination.**—You are now subject to be questioned by the opposing counsel, with the object of weakening your evidence as far as possible, by trying to show how your details are inaccurate, conflicting, or contradictory. You are for him in the position of a '**hostile**' witness. You must be prepared even for questions calculated to disparage your skill. Thus in a question of criminal abortion you might be asked: You are not an obstetric surgeon? How many cases of midwifery have you attended during the past year? In cross-examination '**leading** questions,' *i.e.* questions which suggest the answer wished for or expected, may be asked; but if the question cannot be correctly answered in this way, you should inform the court accordingly, and in no case attempt to answer questions you do not clearly understand. Sometimes lawyers unfamiliar with medical science ask meaningless questions.

"Facts not otherwise relevant are relevant if they support or are inconsistent with the opinions of experts, when such opinions are relevant." *Illustration* (*a*).—The question is whether A was poisoned by a certain poison. The fact that other persons who were poisoned by that poison exhibited certain symptoms which experts affirm or deny to be symptoms of that poison are relevant.—*I. E. A.*, *s.* 46.

3. **Re-examination.**—This is made by the counsel of your own side for the purpose of explaining apparent inaccuracies or discrepancies in your statements which may have been brought out by your cross-examination. No new matter may be introduced at this stage without the consent of the judge or

[1] *I.E.A. ss.* 137, 138 *et seq.*

the opposing counsel, and the opposing side may cross-examine on the fresh point. The judge and jury may question you at any stage to clear up ambiguous points. It often happens that the medical evidence is so little in dispute that no cross-examination is held.

Questions which may be asked.—For a list of many of these, see Appendix I, which should be carefully studied in detail, as several of them will almost certainly be asked.

Hints on Giving Evidence.

The medical witness should remember that he is not, and should not be, a partisan on either side. He has come to tell the truth, what he *knows* about the case, and not to clench the case against the prisoner. As he is not omniscient, he must not be ashamed to say, 'I do not know.' His evidence ought to impress the judge and jury, and, if he can, he should try to make his evidence a self-evident truth.

Notes in court.—All facts of medico-legal importance observed by you in a case should always be committed to writing in your own hand, on the spot, with precise time and dates, or as soon after as possible, and such notes may be taken to the court to refresh your memory, provided permission of the court is obtained.[1] But as the evidence of a witness must be oral, as far as possible, you are not allowed to read out such notes, as evidence to the court. In giving date and time state it precisely, 'On Tuesday the 9th December, 1919, I saw Mr. P., at 7.15 a.m.,' etc.

"A witness may, while under examination, refresh his memory by referring to any writing made by himself at the time of the transaction concerning which he is questioned or as soon afterwards that the court considers it likely that the transaction was at that time fresh in his memory. The witness may also refer to any writing made by any other person and read by the witness within the time aforesaid, if when he read it he knew it to be correct. Whenever a witness may refresh his memory by reference to any document, he may, with the permission of the court, refer to a copy of such document: Provided the court be satisfied that there is sufficient reason for the non-production of the original. An expert may refresh his memory by reference to professional treatises" (*I. E. A.*, *s.* 159). Any writing used to refresh memory must be shown to the adverse party if required (*I. E. A.*, *s.* 161).

Speak slowly, loudly, and distinctly, to allow both judge and recorder to hear easily, and to make notes of what you say.

[1] *I. E. A.*, *s.* 159; *Niz. Ad. Rept.*, 4th April, 1854.

Use plain and simple language, avoiding technical terms which are not intelligible to non-medical persons, such as 'cicatrix,' 'contusion,' 'gastric mucous membrane,' 'pericardium,' 'ecchymosis,' 'traumatic,' etc.; employ instead 'scar,' 'bruise,' 'lining membrane of the stomach,' etc.

Avoid superlatives and exaggerations. Avoid such expressions as "there was an enormous bruise on plaintiff's shoulder, the blow must have been a savage one delivered with great violence," and that "the pupils were pin-points."

Be precise and concise. For example, be prepared to give the date and time of each event about which you have to give evidence, the exact measurement of wounds, the exact weight of solids, and volume of fluids, etc. Photographs should be utilized if available.

State facts only, not mere opinions, unless expressly asked for these latter. Thus, in the case of suicidal hanging, you should only certify to the fact of hanging, for whether it is suicidal, or homicidal, or accidental, is a matter of expert opinion or other evidence. Give your answers irrespective of the possible result on the trial.

Keep your temper during cross-examination. To lose it would convey the unfavourable impression to judge and jury that you are hasty in forming conclusions and therefore untrustworthy. If compelled to answer 'Yes' or 'No' to a question in cross-examination when it would convey a false impression, qualify it by an explanation; and appeal to the judge if you think any question unfair.

Professional secrets.—In a court of law a medical adviser is bound, if asked, to disclose otherwise inviolable secrets, if not self-incriminating, which he may have had confided to him professionally by a patient, as in questions of legitimacy, venereal disease with reference to divorce, etc. If the medical attendant through conscientious scruples refuses to answer, he is liable to be committed for contempt of court. In such cases it is well for the medical man first to appeal to the judge for a ruling, claiming privilege to decline to give such secrets, so that if the judge still rules that it is necessary for you to speak, it will be evident to all that you divulge these secrets only under compulsion of the law of the land.

Lord Mansfield in 1776 put it very clearly—"If a surgeon was voluntarily to reveal secrets, to be sure he would be guilty of a breach of honour; but to give that information in a court of justice which by the law of the land he is bound to do, will never be imputed to him as any indiscretion

whatever" (Duchess of Kingston's trial for bigamy, 20 S. T., pp. 573, 735). Certainly even in *civil* (non-criminal) cases there is a great deal to be said in favour of the existing law, for surely in the interests of humanity and purity it seems undesirable that a woman to whom a loathsome disease has been communicated by a dissolute husband should find herself chained to him for life, and be unable to gain the ordinary means of redress, because the only witness who can prove this material medical fact has scruples of conscience, or is technically excluded from testifying. *For further remarks on this subject* and a case successfully resisted, see Chap. XIX., on 'Medical Obligations.'

Quotation from books.—You are not allowed to quote in your replies any books by an author who is alive, on the principle that evidence should be oral, and the giver of it should be present for cross-examination. Books are sometimes quoted in court by counsel, and the witness is asked whether he agrees with the quotation. In such cases the witness should, before replying, ask to be allowed to read it over himself, and see whether the context does not give it a different meaning from that assumed for it by the opposing counsel.

In giving an opinion in court be well prepared beforehand, by having considered the various points on which you are likely to be called upon to give an opinion, what inferences drawn from the facts would tend to support either side of the case. Consult the works of the leading authorities on these points; ascertain what opinions are therein expressed, and the grounds on which such opinions are based, and frame your own opinions with due regard thereto. Be careful to draw no stronger inference and give no stronger opinion than the facts warrant. It frequently happens that the facts available do not justify a conclusive opinion being given one way or other: in such a case do not hesitate to state so; but be prepared to state precisely your reasons for being unable to give a definite opinion on the point.

Lying in Forensic Psychology.

Lying is one of the great difficulties with which the Medico-legal expert, in common with the Judge, has to grapple in Europe, and it is by no means less prevalent in India. Children, otherwise mentally sound, especially if their moral education has been defective, or they have been associated with liars, may occasionally tell a lie from motives of fear, or to gain some private desire, or screen a friend, at a period when they are not yet able to distinguish clearly between their desired ideal and the moral quality of the means employed to obtain it. But it is the adult liars who lie deliberately with the purpose to

deceive, with whom we have seriously to deal, and for whom there is no such excuse, and who constitute a menace to society and civilization.

Habitual lying, to a greater or less extent, appears to be much more prevalent in civilized communities than is generally admitted, although only a relatively small proportion of the individuals who practise it find their way to the criminal or police courts. It inevitably tends in the direction of crime, and is associated usually with some physical defect in the brain; it is absent relatively or absolutely in the higher normal and well-balanced types of brain and intellect, to which lying in all its forms is repugnant; while it is notoriously prevalent in degenerates, imbeciles, and insanes. A common feature which the habitual liar shares with the feeble-minded, epileptic, hysterical, and insane, is that they are not a whit abashed at being found out. They are thus "Pathological Liars," in contradistinction to the "Occasional Normal Liar," who tells a lie occasionally to conceal some inconvenient truth, or it may be deliberately to get some person, against whom a spite is cherished, into trouble—a common motive both in India and in Europe. Between the habitual and occasional lying comes a good deal of partisan literature other than "fiction," and certainly that of belligerent politicians in war-time, who thus approximate to the imbeciles and insane.

The Pathological Liars, however, are seldom so completely diseased as to be altogether insensible to the difference between right and wrong, even when subject to hallucinations. They usually know their stories are false, but they wish they were true, and they hope by cunningly contrived plausibility that people may be deluded into accepting them as true. They are often extremely clever and personally attractive. Some enjoy success as swindlers, others have caused grief to their families by figuring in *causes célèbres* in which they accused their parents or guardians of the most abominable crime, weaving tales so plausible as to deceive the general public.

An interesting analysis of the antecedents and psychology of over sixty well-authenticated cases of such inveterate liars has recently been published by the Drs. Healy,[1] which shows that invariably there has been some mental defect in the family, which may range from mere inability to resist alcohol up to actual insanity. The patient herself—for it is to the female sex that most pathological liars belong—generally has shown a tendency to excessive lying in childhood, in the years when character is forming. In some cases this may have been

[1] *Pathological Lying, Accusation, and Swindling.* By W. Healy, M.D., and Mary T. Healy, B.L. London, 1915.

imitative in a home where some member of the family was notorious for lying, or keeping up a social position by "make-believe." In other cases it may be due to the influence of bad companions. Often a good conversationalist and sometimes a ready writer, "she is *intensely self-centred, caring nothing for the opinion of others. Though prone volubly to embroider facts or invent interesting occurrences in which she plays a leading part, she is as a rule suggestible. Very often she runs away from home* and is found by kind-hearted strangers to whom she tells a thrilling tale of how her parents beat her, till it dawns upon the philanthropist that he is harbouring an incorrigible liar; though on the other hand, owing to their innate cunning, they may never be found out and exposed." Such are the class who bring false charges of immoral assaults. Habituées to the abuse of alcohol, morphine, and cocaine are also especially addicted to lying to conceal and facilitate their vice, and may be classed as pathological liars, who tend in the direction of crime.

It is only by careful questioning, cross-questioning, and traps carried out at more than one interview, that one is likely to elicit the real facts and reconstruct the true case.

Special Difficulties in detecting Crime in India Medico-legally.

Some of the special difficulties in the way of the medical jurist in India getting at the truth in criminal cases are due to :—

1. Rapidity with which decomposition destroys dead bodies in the hot climate.
2. Facilities for concealing and destroying dead bodies, together with the general practice of rapid cremation or burial a few hours after death.
3. Insufficient particulars of crime in the police reports accompanying the alleged assaulted person or a decomposed dead body.
4. Untrustworthiness of so much native evidence, owing to the wide prevalence of false swearing and fabricating false charges.

1. **Rapid decomposition.**—This tends to obliterate the traces of the cause of death whilst rendering the autopsy very trying to the medical officer, whose duty nevertheless is to perform the examination as thoroughly as possible. The despatch of the dead body or its preliminary examination is often in country districts delayed in the hot weather for several hours with

consequent loss of evidence, owing to the responsible official shrinking from contact with the dead body until evening or the next day, as contact with a corpse prevents a Hindu mixing with his family or friends until purified by more or less elaborate ceremonial bathing. For this reason, a fudged report may be sent in without the body having been inspected at all. When, as often happens, the body does not reach the medical officer for examination until several days after death, after having been carried scores of miles in the heat on men's shoulders, it is then in such a horrible putrid condition [1] as to make even an external inspection very trying, and detailed dissection useless. It is thus necessary that the police report accompanying the body should furnish the medical officer with sufficient particulars to indicate the direction in which he should pursue his search into the cause of death. Otherwise when decomposition has fully set in he cannot be expected to throw much light on the cause of death. Nevertheless it is well never to refuse to make an examination even in such cases. For wounds inflicted during life can, for a considerable time, be distinguished in the dead body from those inflicted after death and from mere decomposition changes. Certain tissues, such as those of the uterus,[2] resist decomposition for a long time; certain poisons (such as arsenic) may persist for many months, fractures will be evident, though, if the decomposition is far advanced, it will be difficult to say whether the fracture occurred during life or not, and some important identification marks may be elicited.

2. **Rapid cremation or burial of bodies.**—The bodies of Hindus on death are cremated and those of Mohammedans are buried on the day of death, usually a few hours after apparent death. European residents also are almost invariably buried on the day they die. Besides these legitimate methods of disposal, very poor people often throw the bodies into rivers and lakes. Unusual facilities thus exist for destroying traces of murder by concealing the dead bodies in rivers, wells, ponds, swamps, dry watercourses, thickets of waste land and jungle, rubbish heaps, standing crops, stacks of wheat or straw, or heaps of chaff. Most of these places are infested by carrion feeders (dogs, jackals, vultures, crows, crocodiles, fish, rats, etc.),

[1] Although the statute [*C. P. C.*, *s.* 174 (3)] expressly states that bodies have to be sent for medical examination in doubtful cases, only "if the state of the weather and the distance admit of its being so forwarded without risk of such putrefaction on the road as would render such examination useless"—this provision is not usually observed, and the thin sprinkling of wood-charcoal does little to check the advancing decomposition.

[2] *Niz. Ad. Rept.*, N.-W. P., 1854, 204; *id.*, 1852, p. 1121.

which soon mangle the corpse beyond recognition or reduce it to a skeleton. The commonest way of disposing of the body of a murdered person in the plains is to throw it into a river, or into a disused well—for this purpose it may be trussed up and carried many miles from the scene of murder, or tied to a pole and dragged along if the murderer be single-handed. The next most common way is probably to hide it in the jungle. Occasionally such bodies are buried under the mud floors of houses, and usually in the house of an innocent party. Certain Hindus who murdered a fellow-Hindu and his mistress plotted to bury the woman's body in a Mohammedan grave, which no one would think of opening, and to leave the man's body in the house to make it appear that he had been murdered by his mistress, who had absconded. A case came under my[1] notice where the body of the murdered man was buried in the bed of a hill stream, which for this purpose had been diverted from its channel and then turned on again.

3. **Insufficient particulars in the police-report which accompanies the body.**—In India the medical officer rarely sees the dead body when and where it is found, and has to depend for such important information on the meagre and vague reports of untrained persons. Such statements as "believed to be beaten," etc., are often contradictory, and give little useful or trustworthy clues. Although it is a principle in England that the medical officer should be furnished with as full particulars as possible to assist him in finding out the true cause of death, this principle has been objected to by an Indian judge.[2] If, however, the medical officer, who holds the position of a police-surgeon, be purposely kept in the dark as to the facts and ascertained circumstances attending a death on which he has to report, with only the decomposed body available for examination, there must necessarily be a great likelihood of justice miscarrying.

[1] L. A. Waddell. It occurred in the Ranchi District of Chota Nagpur in 1886, while I was acting there as civil surgeon.

[2] The civil surgeon of Cawnpore, in 1852, with reference to a body which had been sent to him without particulars as to the alleged cause of death, asked that in future he should be supplied with the history of the bodies sent to him for report, so that he might have some guide to the organs most requiring scientific examination. But the sessions judge thought "this would interfere with a principle of criminal justice and would be analogous to putting leading questions, the answers to which would not be evidence, nor would it be fair to the prisoner, for though a severe sword-cut might be reported on, the presence of a disease, lung or spleen, might pass unnoticed, though the actual cause of death." The superior court in their remarks on this case decided that "the communication which had passed between the sessions judge and the civil surgeon was altogether irregular and objectionable."—*Nizamut Adawlut Reports*, N.-W. P., December 21, 1852.

4. Falseness of much of the evidence given by natives of India.

> "*No crime causing loss of caste is committed by swearing falsely to women the object of one's desire, at marriages, for the sake of (procuring) fodder to a cow, or fuel (for oneself), and in order to show favour to a Brahman.*" —MANU CODE 11, 26.[1]
>
> Yet the disgrace of perjury is also insisted upon: "*Naked and shorn, tormented with hunger and thirst and deprived of sight, shall the man who gives false evidence* go with a potsherd to *beg food at the door of his enemy.*"—MANU, 9, 235, 319, 325.[2]

The untrustworthiness of native evidence in India is notorious. In nearly every case in law, more or less false evidence is given, whether it be from fear, stupidity, apathy, malice, or innate deceit. It is referred to by the Privy Council as[3] "the lamentable disregard of truth prevailing amongst the natives of India." As regards Bengal, the Inspector-General of Police[4] states that this "is a country where perjury is the rule and not the exception, where no man will tell the whole truth or the simple truth . . . where false witnesses can be bought for a few annas." The constant difficulty, therefore, is to sift the truth from the falsehood. Such false charges are generally supported by marvellously minute direct and circumstantial details. The "too perfect" character, indeed, of such evidence at times leads to it being suspected and its falsity exposed.

A very common form of conspiracy is to cause a person to disappear, and then to charge with murder some person against whom a spite is cherished. A plausible explanation is given of the disappearance of the body of the alleged murdered person, or a putrid corpse is obtained from the adjoining river and, gashing it in several places, it is brought forward as the remains of the missing individual. In such conspiracies circumstantial details are not infrequently sworn to by several persons, testifying as eye-witnesses to alleged facts of the murder, to the burial of the corpse, etc., so that conviction for the murder may be duly passed, and the falsity of the whole

[1] *Laws of Manu.* Translated by G. Buehler. [2] *Id.*
[3] Cowell, quoted by Chevers, *M.*, p. 86.
[4] *Rept. Beng. Police* for 1866, pp. 10, 53.

proceedings not be discovered until the reappearance alive of the alleged murdered person.

Cases.—(*a*) **False evidence.**—Ibrahim Beg, a wealthy *mahājan* (merchant), was convicted of the murder of his young wife Chumbelee. On the day previous to the one appointed for the execution of the convict, an individual informed a young English civilian that Chumbelee was alive, and led him to the place where she was kept concealed by a gang of *fakirs* in a subterranean chamber of a tomb. It then turned out that the whole affair was a conspiracy got up by a man named Khan Beg, the *mahājan's* next heir. This man, with the assistance of one of the *mahājan's* servants, first excited Ibrahim Beg's jealousy, and led him to beat his wife. Her loud screams were heard by the neighbours. They then abducted the wife and handed her over to the *fakirs*, in whose custody she was subsequently found. Just before the quarrel between Ibrahim Beg and his wife, the conspirators had got hold of a female body. They cut off the head of this, put on the arm of the corpse one of Chumbelee's bangles, and buried the body in the courtyard of Ibrahim Beg's house. Here it was discovered on the day after the quarrel, and was supposed to be the body of Chumbelee. The man who gave information that Chumbelee was still alive was a subordinate in the affair, who was dissatisfied with the remuneration given him for his services.—Chevers, *Man.*, p. 54.

(*b*) Regarding another case, the sessions judge wrote:—"It would be impossible to imagine a case more completely satisfactory as regards at least the guilt of Abdool Kurem [the falsely accused] than this, because when the [police] darogah's report was completed, and as in fact it remained until the appearance of Pertab Narain [the alleged murdered man] brought to light its real character. The prosecutrix was the mother of the missing man, the principal witnesses were his wife and his cousin, while the prisoner's own servants detailed at length circumstances attending the burial of the body. There were no inconsistencies and no contradictions in the evidence, which from first to last gave the hearers the impression that a heinous crime had indeed at last been brought to light, in spite of a powerful combination to conceal it."—*Niz. Ad. Rept.*, 1853, I. 259. Other cases of this kind.—*Niz. Ad. Rept.*, N.-W. P., 1854, 381; *Police Rept.*, L. P. 1844, p. 37.

False confessions of fictitious murder.—The falsely accused persons, even when not the subject of delusional insanity, may confess to have done the alleged murder and yet the alleged murdered person appears alive in court:—

Case.—In the Mirzapur district, a Rajput widow known to be unchaste eloped with a paramour. The headless body of a woman was found in a well, and was supposed to be the body of the widow who had eloped. The widow's brothers were charged with her murder, confessed their guilt (?), and were convicted. Just before they were sentenced the missing widow appeared; she had heard by chance that her brothers were charged with killing her, and came forward to clear them. The brothers said they had confessed to the murder because they thought it was hopeless to plead innocence.—Chevers, *Med. Jur.*, p. 69.

False evidence fabricated by police.—The native police, whose duty it is to make the preliminary report on criminal cases, are drawn from the ranks of the masses, and many are

still credited with suppressing incriminating evidence for a monetary consideration, as well as with extorting false confessions by torture or threats through mistaken zeal or other motive, all tending to obscure the truth. Thus a head constable at Rangpur in Bengal induced a woman to say that a certain corpse found floating on a river was that of her adopted father. He further instigated her to charge five men with the murder. At this juncture a sub-inspector took up the case, and the five men were arrested and kept for the night in the custody of these constables, who maltreated their prisoners and thereby induced them to confess that they had committed the murder. When the trial was going on the missing man came into court.[1] Again a sessions judge records:—"I do not credit the evidence of the eye-witnesses as to the place where and the mode in which the wound was inflicted . . . the eye-testimony of the knife and the blow on the road was an after-thought of the police to make the case more complete according to their infamous custom in these parts."[2] So much suspicion clings to the evidence offered by the police that it is specially enacted that[3] "no statement made by any person to a police officer in the course of an investigation under this chapter shall, if taken down in writing, be signed by the person making it, nor shall such writing be used as evidence."

The Indian Criminal.

Indian experience generally supports the modern school of criminal anthropologists in regarding the criminal as a degenerate. Lombroso's hypothesis, which originally was that a criminal type exists exhibiting a physical neurosis, or degeneration of the brain that enables us to recognize a malefactor from birth, has now undergone a good deal of change. So far, no physical signs which point to absolute criminality have been discovered, any more than it has been possible to discover the external marks of invincible honesty. Yet, although the great malefactor is not usually a madman, but exhibits a marked degree of self-control, lower down in the scale of criminality, it is often very difficult to decide how far the creature in the dock is truly responsible. Certainly, prisons all the world over contain a considerable proportion of persons under punishment who are little better than half-witted. The population of almost any of the large prisons exhausts the scale

[1] *I.-G. Bengal Police Rept.*, 1866, p. 47.
[2] *Nix. Ad. Repts.*, V., Part 2, 1855, p. 812.
[3] *C. P. C.*, *s.* 162.

of unfitness, and from it is recruited a good deal of the population of the lunatic asylum.

The classification of criminals by Lombroso still holds generally good, namely (1) the *political criminal*, who may be, as the Italian sociologist calls him, "the true precursor of the progressive movement of humanity," and may be the hero, martyr, or even saint of another land or age; (2) the "*criminal by passion*," usually distinguished by a previous honest life and genuine remorse; he never becomes a recidivist, his crime is usually a solitary event in his life, and careful examination as a rule fails to show any striking evidence of abnormality, degeneration, or hereditary taint in the political criminal or the criminal by passion; (3) the *occasional criminal*, who has an element of innate criminality which leads him to commit crime when an opportunity offers, and bad heredity is common in this class; (4) the *habitual, or professional criminal*, who deliberately adopts a career of crime, and commits it either helplessly, the degenerate class, or with great intelligence, the aristocracy of criminality; (5) instinctive or congenital criminals (*criminel-né* of the French, *delinguente nato* of the Italian). Lombroso identifies the instinctive criminal with the moral insane. Criminals of this class form only a small percentage of the prison population, but they are the most serious proportion. They frequently present well-marked physical and psychical signs of abnormality, degeneration, or disease. They reveal criminality in its most pronounced shape, and they are related on one side to the occasional criminal, and, on the other, pass gradually into (6) the *insane criminal*, without any clear line of demarcation between them.

That the criminal is "an epileptic more or less in disguise" is no longer held, as it is not supported by fact; but that the criminal type is often a "*professional*" type has a good deal in its favour, though the rapid extinction of vicious families who choose such a career is not favourable to the hereditary transmission of such aptitudes.

As an outcome of this conception of the criminal as a degenerate and a more or less half-witted person, there has been put forward the ethical and eugenistic plea for the reclamation and education of the criminal, less rigorous punishment, and the total abolition of the death penalty, for no doubt crime springs from conditions which punishment cannot touch. But these questions are outside the scope of this book.

The Indian criminals are perhaps, broadly speaking, of a somewhat milder and less vicious type than the average criminal in Europe. There are relatively fewer of that gross, anti-social type of moral monster who infest society under the

stress of the higher civilization. The great majority of violent criminals and murderers in India are "*criminals by passion*," fairly well-meaning and generally law-abiding men, who, stung into sudden madness by some insult or wrong, real or fancied, to themselves or families, take justice or retaliation into their own hands, and so find themselves in the clutches of the Law. A large number are criminal through natural stupidity and want of self-control, rather than inherent wickedness.

Moral Insensibility, a truly criminal trait, is, however, often seen in atrociously unnatural motives for crime in India. It appears also to enter into the well-known apathy, usually considered fatalistic, amongst natives of India, towards saving life in accidents. People will look on calmly at the struggles of a drowning man without attempting to render him assistance, and often do not attempt to save the victims of attempted murder. Thus, a young woman was seen by a man at noon to throw a boy of ten down a dry well twenty feet deep. The man never attempted either to catch the murderess or to help the child in the well. He excused himself by saying that he had a boil on his foot and a load on his back. Without throwing down his load he went on to his village, and informed the child's father. The latter, again, made no attempt to recover the body until the evening.

Inhuman *callousness* is sometimes displayed: thus, a woman murdered a child for its ornaments, which were worth less than six rupees (about eight shillings), and was found burning the child's body at her own fireplace (*Beng. Pol. Rept.*, 1866, 172).

Murder of own family to fasten a charge on an enemy.—The victim is usually an old infirm person or a child. Numerous such cases occur every year. A woman in Patna district poisoned her own little daughter, and concealing the body on the premises of a neighbour with whom she was at enmity, accused him of having murdered her.[1] "A man in Jhansi (1885) killed his daughter because his neighbour had slandered her in order that the girl's blood might be upon the neighbour's head. A master murdered his servant (1881) and threw the body before the door of his enemy solely in order to bring a false charge against the latter. A similar case occurred in Azamgarh five years later; a boy was murdered by his grandfather and uncle; they threw the body into a sugar-cane field, and then charged the owner with the crime. A still stranger story comes from the Mathura district. Randhir, a Jat, who

[1] *Bengal Police Rept.*, 1868, p. 139.

had once been a thriving man in Randhirpur, fell into the hands of the money-lenders, lost his property and his house, and became for some crooked reason embittered against his old fellow-villagers. He made up his mind to bring them into trouble. Taking his chopper with him, he met a little *chamár* girl, whom he took into a temple in Bahadurpur. There he cut her throat and slightly wounded himself, and then brought a charge of dacoity and murder against the people of his old village."[1] A man sentenced at Cawnpore as accessory to the murder of his own sister confessed that the deceased's own son and another relative had beaten her to death and had absconded with her property, and that he afterwards witnessed the partial burial of her body in one of the apartments of the house in which they all resided as a joint-family. He had deceived the neighbours as to the cause of the unpleasant effluvium which proceeded from his house, by attributing it to the death of a snake in one of the drains. The body was found several days after the murder in a locked room, the key of which was in the prisoner's possession.[2]

Case.—(*a*) **Murder of father by son** amid crowd of witnesses in broad day *to lay false charge at another man's door.* In 1902, a dhobi of the village of Kalanjari, thana Jani, in the district of Meerut, found that some clothes which had been given to him to wash had been stolen. He suspected two Dhanuks of the village, who had been in his service as watchmen, and a relative of theirs, and brought them before the zemindars. The Dhanuks protested that they knew nothing about the clothes, so the dhobi, Ramzani by name, reported the matter at the thana. The head-constable of Jhani and two other constables returned with Ramzani to investigate the matter, and the head-constable took up temporary quarters at the house of a Jat zemindar named Jhunku, this apparently being the customary thing in the village. After making several inquiries, and inspecting the hut from which the clothes had been stolen, the head-constable, whose name was Niaz Ahmad, called several zemindars to the house of Jhunku, presumably to assist in the inquiry, and afterwards sent a chaukidar to fetch the three suspected Dhanuks. In answer to the summons, about a dozen Dhanuks turned up with their women-folk, making a great noise as they approached Jhunku's house. They were armed with *lathis*, and evidently meant mischief. Niaz Ahmad asked them the reason of this conduct, and one Siria, who seems to have been the ringleader of the party, replied, "Jhunku wants to get us all summoned. We have come to see how he will do it." Jhunku replied, "Why should I have you summoned? Those who are the thieves will be *chalaned.*" The head-constable added, "Don't make a noise, justice will be done." "How will justice be done?" replied Siria, "we will get Jhunku summoned first." Saying this, Siria gave an old Dhanuk, who was standing beside him, a push, with the result that the old man fell, striking his head against the *chabutra.* The old man was Siria's father, Chimman by name, and was about sixty-five years of age. Several of the Dhanuks then cried out, "Kill the old man and accuse Jhunku," and

[1] Kitt's *Serious Crime in an Indian Province*, 1889, pp. 14, 15.
[2] *Niz. Ad. Repts.*, N.-W. P., 1853, p. 765.

several of them began to strike the prostrate man. They seized the man by the legs and dragged him fifteen paces away, and then Siria jumped on his chest. The police and zemindars appear to have made some ineffectual attempt at rescue. The Dhanuk tumbled the old fellow on to a charpoy and marched away in the direction of Meerut. There are two witnesses who state that they encountered the party on its way to Meerut, and that the Dhanuks told them that Chimman had been assaulted by Jhunku, and that they were taking him to the police-station. Chimman, however, feebly protested from the charpoy, saying that he had been assaulted by the Dhanuks themselves, and that they wanted him to bring a false case against Jhunku. By the time they reached Meerut old Chimman was dead, and the Dhanuks charged Jhunku and several others with the murder, saying that the reason for the crime was that Jhunku and the police had demanded money from them in connection with the theft case, that they had refused, saying that they had none, that Chimman had expostulated, and that for this he had been done to death with *lathis*. The magistrate and the judge both disbelieved the story of the defence and believed the story told by the police and the zemindars. The magistrate characterized the crime as most strange, unnatural, and revolting, and the judge agreed with him. He sentenced Siria to be hanged, three others to be transported for life for the murder, besides finding them guilty of fabricating evidence against Jhunku, with the intention of causing him to be convicted of murder. He found six more Dhanuks guilty of abetment of the second crime and sentenced them to various terms of imprisonment.—Allahabad High Court, JJ. Knox and Blair, 1902.

Case.—(*b*) **Murdering adult brother.**—On the morning of the 17th December, 1901, the decapitated body of one Tahal Singh was found in the field of Pertap Singh in the Gurdaspur district of the Punjab. Suspicion was at first directed against Pertap Singh, but the police were able to discover that on the night of the murder the deceased had been last seen in the company of certain persons including his own brother and the lumbadar of the village going towards the field where the body was found next morning. "It also transpired," we quote the words of the police report, "that on the 16th December the murdered man and his brother Mahal Singh were drinking at a liquor shop in Nowshera, and there the murdered man, who was rather intoxicated, invited certain friends to drink with him saying it was the last opportunity they would have, as he would soon be in two or four pieces. The brothers then went to Kotla, where the other accused were assembled, and had more drink." By the advice of the public prosecutor a pardon was offered to the brother of the murdered man, and his story was as follows:—"He, his brother, Tahal Singh, and the lumbadar, were great friends, and they had a common enemy in one Pertap Singh of Bulewal, between whom and themselves there had been a considerable amount of litigation. At the time of the murder Pertap Singh had brought a charge of assault against him and his murdered brother (Tahal Singh), and Pertap Singh's son had a similar charge pending against the lumbadar. They arranged that Tahal Singh should be murdered, his body put in Pertap Singh's field, and a charge of murder brought against him. Tahal Singh consented to be killed for this purpose of revenge. On the night in question the party proceeded after a drinking bout to Pertap Singh's field, the lumbadar carrying a *gandasa*. On arriving at the field accused No. 1 threw Tahal Singh down, and he and the lumbadar gave their superfluous clothes to accused No. 5 to hold. The lumbadar then seized the murdered man by the hair, while he himself and Bela Singh, accused

No. 4, each seized a leg. Budha Singh, accused No. 1, decapitated the deceased with the *gandasa*. All then went to Kotla, where they washed their hands and feet at a well and burned some of the murdered man's clothes in the lumbadar's courtyard. The *gandasa* belonged to accused No. 1 and was found in his house by the police."—*C.M.G.*, 11th Feby., 1902.

Case.—(*c*) **Butcher murders his child** to please paramour.—In June, 1901, before the Allahabad High Court, Mula, a butcher of the sweeper caste, resident of mohalla Naimandi, Rekabganj, Agra, was convicted for the murder of his daughter, a child of four years of age. According to the evidence and the confession of the accused, Mula had had an intimacy with Musamat Koka, a sweeper, and used to live at her house. Shortly before the murder took place Koka left Mula and went back to live with her own husband. This seems to have put Mula into a state of fury, and he threatened to cut off the woman's nose. On the night before the murder he visited her and during his visit struck the woman's year-old child. According to Koka, the man threatened to kill the child. The woman got into a rage and cried out, "Why should you kill her, you give her neither food nor drink; why don't you kill your own child?" According to the accused, the woman asked for the body of his own child. Mula went away and slept in his own house that night. In the morning he took his daughter to the slaughter-house, where he was employed as a butcher, and cut the child's throat in the manner animals are slaughtered. The man then took the body of the little girl to the house of Koka and entered the room in which she and her husband were sleeping. Before awaking Musamat Koka he laid the body of the girl on a bed on which Koka's husband and Koka's son were sleeping. He then roused the woman and asked her to give him a smoke, saying, "God knows whether I shall live or die." She pointed out the tobacco at the fireplace. He brought fire from the fireplace and prepared his *chilum*. He then asked the husband to smoke, addressing him in the same words, and the husband waking up, asked what was the matter. He showed him the body lying on the charpoy and said he had killed the child at the bidding of Koka.

Self-murder in revenge.—Cases are sometimes met with in which an individual who has been injured by another kills himself under the idea that he thereby throws the responsibility for his death on the person who has injured him. Instances quoted by Chevers show that, under the name of '*chandi*' this form of suicide was a well-known custom among the ancient Rajputs. A variety of this description of suicide is the practice known as sitting '*dharna*' or starving himself at the door of an enemy or debtor. Again, Chevers mentions a case of a man at Singapur who cut his throat at the door of his neighbour in order to try to get the latter hanged.

Parents sometimes conceal the murder of their son or daughter, and report the death as being due to attack by wild beasts or suicide.[1] So common is this moral insensibility to natural ties that the High Court refers to it as "instances of persons consenting to forego the prosecution of those who have

[1] *Beng. Police Rept.*, 1849, p. 8.

committed the most serious injuries to their persons or properties are within the common experience of every magistrate in this country." [1]

Some Special Causes of Crime in India.

A good deal of the crime against the person in India is the result of the primitive social state of the mass of the people and the observance of semi-barbarous cults and traditions handed down from the past, and often based upon primitive tribal instincts of self-preservation, but which now under British rule are illegal and criminal.

Traditional Customs.—Many such practices which nowadays under British rule are crimes were not deemed to be such under Hindu and Mohammedan rule. Instances of these are the burning of widows alive on the funeral pyre; female infanticide; burial of lepers alive; 'justifiable suicide'; condonable murder or manslaughter (see below); and avenging certain wrongs, *e.g.* adultery, by taking the law into one's own hands. In ancient India the avenging of all criminal justice remained in the hands of those who were wronged; and still to the present day it is not fully recognized that the enactments under British rule have diminished the sphere of private revenge. *Mutilation* of nearly every part of the body was authorized as a punishment in Hindu law. Thus, the hand or foot, both hands, one hand and one foot, both hands and both feet, buttock, lip, penis, testicles, pudenda, rectum, ears, nose, breaking the teeth, finger or fingers, piercing or gouging out the eyes, etc., were specified punishments. *Burial alive* was a recognized Mohammedan torture, and Hindu sacrifice is still sometimes practised even nowadays. *Torture* is still believed to be often resorted to clandestinely by the police to exact evidence, and trial by ordeal is still not infrequent.

In the Vedas the crime of manslaughter (*Vaira-hatya*) was condoned on payment of the price or blood-money termed *Vaira*, payable to the relatives of the man killed. The scale of payment prescribed was 1000 cows for a person of the Ksatriya caste, 100 for Vaiśya, and 10 for a Sūdra; and over and above this was in each case a bull which it is supposed was the perquisite of the king for his judicial intervention. The crime of slaying a Brahmin was too heinous for a fine. It was a sin which could only be expiated by the performance of a horse-sacrifice (*Aśvamedha*), the *ne plus ultra* of generosity to Brahmins. In this sacrifice the human victims seem to have included not only the plaintiff and defendant but also the arbitrator.—*Vedic Index*, Macdonell and Keith, 1912, I., 331, 391, 393.

[1] *Niz. Ad. Repts.*, Vol. VI. (1856), p. 801.

Five kinds of suicide are considered justifiable by Hindus: It is written in the *Brahma Purana:* "Let the man who is afflicted with a grievous and incurable disease enter a burning fire, or procure his death by starvation, or by plunging into unfathomable waters, or by precipitating himself from an eminence, or by ascending to paradise by a respectful pilgrimage to the Himalaya Mountains. Whoever relinquishes life under these circumstances, by precipitating himself from the sacred *vista* tree at Prayága, or, his time being come, destroys himself, that high-minded person shall receive a great reward in a future state, and shall not be considered a suicide; even although he might have been a great sinner, he shall meet with supreme bliss in paradise. The privilege of practising the above-named austerities is extended to the human species in general, without restriction either in regard to sex or tribe.—Macnaughten, *Niz. Ad.*, I. pp. 220–1.

Cases.—(*a*) **Intentional live-burial of wife.**—In 1907, in the Betul district of the Central Provinces, in the case of a man, Dama, charged with the murder of his wife, it was proved that the wife, Indro, had been for a long time suffering from chronic dysentery, and on 29th January, 1907, the woman's husband, Dama, the accused, took her and the family away to another village, where he abandoned his sick wife and returned home with his children, and stated that he had left his wife with a *bhagat* or exorcist for treatment. The village authorities sent the poor woman to another village where the husband was sent for, and his wife made over to him, and a cart and bullocks lent him to take her to his home. The accused took the cart, but came back the same day saying that the wife had died on the way and he had buried her. He was ordered to go and report the death to the *Kotwar;* he made no such report, but returned to his own village, and there stated that his wife was alive and under treatment of the *bhagat.* On the sixth day after the alleged death of the woman a villager saw something move in the jungle, and his cattle shied when they went near the place. The next day this villager told the *Kotwar* of this strange incident, and they went and found the mysterious grave, with the leg of a woman clearly visible. They then heard the buried woman say, "I am not dead," and she then told the *Kotwar* that her husband had buried her. The woman's brother-in-law and daughter were sent for, and they lifted the buried woman out of the rough grave and gave her food. She was sent to the Badnur hospital and lived on for some twelve days longer. The extraordinary part of the story, apart from the callousness and superstition of the husband, is the fact that the poor woman must have lain in the shallow grave, covered with leaves and branches, for six or seven days without food or water. The accused was sentenced to transportation for life.—*King Emperor* v. *Dama Gaiki*, 302 *P. C.*, 1907.

(*b*) **Trial by ordeal.**—In 1900, in a village in Madras, a shoe was lost and the village magician was commissioned to discover the thief. He distributed some powders to the assembled villagers, and immediately after eating the powders two boys were seized with violent vomiting, and one of them died. From his viscera three grains of corrosive sublimate were extracted.—*Mad. C.E. Rept.*, 1900, p. 8.

In Burma, a short spell of organized robbery with assault ('dacoity') and even murder is still fashionable amongst the youth of that country to prove their daring and manhood to their sweethearts, and is thus from its audacious motive to be

distinguished from ordinary crime, though it might be classed with professional crime.

Intoxicants.—The relatively milder type of the average criminal is perhaps in some measure due to the relative infrequency of alcoholic drunkenness amongst Indians, as alcoholism is found to contribute so largely to hereditary crime in Europe. Amongst the Burmese, where spirits are more freely indulged in, murderous assaults even on near relatives are not uncommon under the influence of alcohol; in Rangoon alone over 300 sword-cuts of the head occur annually, many of them fatal. But the intoxicant mostly indulged in by criminal Indians is *Indian Hemp*, which accounts for some of the most violent tragedies, such as 'running *amok*,' and other maniacal crimes.

Race and Environments.—In so large a continent as India, comprising so many diverse physical features, climates, and races with different social and religious customs, it is to be expected that some of the crimes against the person, and the mode of committing them, should differ somewhat in character in different parts of the country, and be determined to some extent by the different environments of the people.

The softer and less virile people of the enervating plains wreak their spite or vengeance less by personal assaults than by false charges and subtle poison, or, afraid of bodily risk themselves, they hire ruffians to beat or murder their enemy, and scheme deeply to hide their crime; whilst the hardier up-country people and hillmen, taking the law into their own hands, attack openly and slay with their own hands, regardless of personal risk or blame, and are less cunning in concealing their crime. The wilder tribesman lies in wait for the person he believes to have wronged or bewitched him, and on killing his victim, he makes little attempt to hide the body, and usually admits his guilt at once. Certain crimes are confined to certain tribes or castes, such as the poisoning of cattle, especially by *abrus*-seed needles ('*sui*'), which is done by the *chamár* or leather-worker caste with the object of getting cheap hides for their stock-in-trade.

Religion is responsible for several kinds of crime in India. Those '*sati*' murders perpetrated in the name of religion, in which Hindu widows are induced to immolate themselves on the funeral pyre or grave of their husbands, still occasionally occur nearly every year. In 1901 and 1905 cases occurred at Gaya, although it is over eighty years since *sati* was declared illegal by the British Government.[1] Special police

[1] The law against the self-immolation of widows was passed by Lord William Bentinck in 1829.

precautions have yet to be taken every year to prevent Hindus committing suicide by throwing themselves under the wheels of the idol-car of the god Jagarnath. Female infanticide on account of the religious and social difficulties of marrying daughters still occurs to some extent, especially in Upper India. Abortion and child-murder are most common amongst the unfortunate class of young Hindu widows, for whom re-marriage and social rights are denied by their religion. Amongst Mohammedans sexual crimes are much more frequent than amongst Hindus. Prostitution is much more extensively practised amongst the former, and sexual jealousy resulting in the murder of paramours and favoured rivals is probably the most frequent case of homicide amongst Mohammedans. In Bengal, for example, the greatest number of rape cases are reported from the Mohammedan districts of Mymensingh and Dacca. That fanatical form of homicidal insanity 'running *amok*' is more common amongst Mohammedan fanatics than Hindus.

Domestic characteristics are that women, perhaps more so than in Europe, employ poison rather than bodily violence, and their crime is directed for the most part against their husband, or some rival in his affections; also that domestic quarrels over trifling matters are a frequent cause of suicide in India.

Famine.—Under the stress of hunger in years of famine and scarcity there is a marked increase in such crimes as robbery by violence, and poisoning, homicidal and suicidal.

The foregoing account of the special features of Indian crime, it is hoped, may facilitate our study of Indian Medical Jurisprudence, the wide field of which can be conveniently viewed under the following divisions:—

I.—FORENSIC MEDICINE.

	Chap.
Identification of Persons, Living and Dead	I.
General Examination of the Living in Criminal Cases	II.
,, ,, ,, Dead ,, ,,	III.
Assaults, Wounds, Injuries and Deaths by Violence:	
Non-sexual: General and Special Wounds and Injuries	IV.
Homicidal *v.* Suicidal and Self-inflicted Wounds	V.
Blood Stains, etc.	VI.
Asphyxial Deaths: Suffocation, Hanging, Strangling, Drowning	VII.
Burns, Scalds, Lightning Stroke, etc.	VIII.
Starvation	IX.

I.—FORENSIC MEDICINE—continued. CHAP.

Injuries and Assaults: Sexual Crimes and Offences:
Impotence and Sterility ..... X.
Virginity and Defloration ..... XI.
Pregnancy and Legitimacy ..... XII.
Birth and Delivery, *re* Inheritance ..... XIII.
Rape ..... XIV.
Abortion, or Fœticide ..... XV.
Criminal Infanticide ..... XVI.
Unnatural Sexual Crimes ..... XVII.
Insanity, in relation to the State ..... XVIII.
Leprosy, in relation to the Law ..... XIX.
Life and Accident Assurance ..... XX.
Medical Obligations and Malpraxis ..... XXI.

II.—TOXICOLOGY, or POISONING.

General Characters of Poisons ..... XXII.
Corrosive and Irritant Mineral Poisons ..... XXIII.
Irritant Non-Metallic Poisons ..... XXIV.
,, *Metallic* ,, ... XXV.
,, *Vegetable* ,, ... XXVI.
,, *Animal* ,, ... XXVII.
Nerve Poisons, Cerebral Poisons ..... XXVIII.
,, ,, *Spinal* ,, ... XXIX.
,, ,, *Cerebro-Spinal and Cardiac Poisons* ..... XXX.

PART I.

GENERAL EXAMINATIONS.

CHAPTER I.

IDENTIFICATION OF PERSONS, LIVING AND DEAD.

THE personal identity of the individual in question must be ascertained in all cases which are reported on medico-legally. The medical jurist may also be called upon to establish the identity of a person in cases of suspected foul play resulting in death, and in a great variety of cases, such as alleged assault, rape, disputed sex, fraudulent personation for the purpose of securing property or the prolongation of a lapsed pension, a fraud which is facilitated in this country by the seclusive rights of *pardah nashin* claimed by married women.

Of dead bodies in India it is especially difficult at times to determine the identity, owing to their rapid decomposition by the heat, and their liability to defacement when exposed to the ravages of beasts and birds of prey. On the other hand, the necessity for thorough identification is here all the greater, owing to the custom of rapid burial and cremation, and the occasional practice of supporting a false accusation of murder by causing a person to disappear for a time and bringing forward meanwhile as the body of the missing individual a putrid corpse readily procurable from any river.

In the **routine examination of ordinary** medico-legal cases, it is always well to get the identity of the person or body in question attested by at least two acquaintances, whose name or names should be noted by you in your record, as the personal identity of the individual examined is of such legal importance.

Identification may thus be required of (*a*) a living person, (*b*) a dead body, (*c*) fragmentary human remains, or (*d*) bones only. For this purpose you consider (1) the **sex**, (2)

age (p. 41), (3) **race** and caste (p. 48), and (4) any characteristic **personal marks** or peculiarities (p. 53).

Sex.

The determination of sex is not usually difficult, as mere inspection of the external genital organs is sufficient to settle most cases otherwise doubtful, without resorting to medical evidence. In cases, however, of suspected murder, where the body is mutilated or only part of it or of the skeleton is available for examination, and in the rare instances of doubtful sex due to malformation where succession to property is concerned, it becomes a much more difficult question, requiring expert evidence, as in under-noted cases. The question of sexual capacity and development also arises sometimes in alleged rape, impotence, etc.

Cases.—(*a*) **Pseudo-hermaphrodite**—Levi Suydam. Suydam presented himself as a freeman, and thus entitled to vote in a contested election. Dr. Barry having found an imperforate penis with a depression in the site of the male meatus, a short urethra opening underneath the penis (hypospadias), and a cleft scrotum with a small but perfect testis in its right half, pronounced him to be a male and entitled to vote. Dr. Ticknor, who objected at first, came to the same conclusion. A few days after it was discovered, by his sister's and his own confession, that Suydam regularly menstruated, and had done so for years. His figure was feminine, the breasts were well developed; and on passing a sound into the urethra, instead of reaching the bladder it passed into a cavity like the vagina, three or four inches deep.—*Amer. Med. Jour. Sc.*, July, 1847.

(*b*) *Æt.* fifty-five at death. General configuration that of a woman (during life celebrated anatomists had formed different opinions as to the sex). At the post mortem there were found, on the right side, a withered testicle, a penis, and a prostate gland; and on the left an ovary, uterus, vagina, and fallopian tube.—Tidy's *Leg. Med*, *I.* 353, case 128.

(*c*) **Female as male.**—Professor A. Powell (Bombay) reports that while he was Resident in Royal Hospital, Belfast, a coal porter, named John Walker, was admitted for a scalp wound infected with erysipelas. "He" had always worked as a porter or dock labourer, and had been married for two years. "He" was found to be a woman with normal vagina and ovaries, but a very large clitoris. At the inquest after "his" death, his "wife" deposed that she had no suspicion "he" was a woman.

(*d*) "A person affected with hypospadias was married for twenty years, and during all that time was treated as a female. Sexual intercourse was regularly effected by the canal of the urethra, nor was it until the period just mentioned had elapsed, that it was discovered that the individual was a man."—Ogston, *Med. Jur. Lect.*, p. 52.

(*e*) **Male as female.**—In 1905, Dr. W. Hind reported case of "Miss X.," aged 37, who had two solid inguinal tumours, which she asked to be removed on account of their having become painful through the prolonged standing her occupation involved, and the microscope revealed a *testicular* structure in both. She was 5 ft. 4 ins. in height, and 8 st. 3 lbs. weight, and feminine in appearance and habits; soft voice, with long hair, none on face, well-developed breasts, female external genitalia, but no vagina. She never menstruated, and has four sisters like herself, who have no trace of a vagina, and have never menstruated.—*Trans. Med. Leg. Soc., II.* 117.

A remarkable instance of concealed sex was the case of Dr. James Barry, an army surgeon, who rose to the rank of Inspector-General of Hospitals, and after death was discovered to be a female.

Sex of the Living.—This question may arise in connection with malformed infants where property is left to an heir of a specified sex, though what is the characteristic in law of a male is open to discussion.

Thus in entailed property with succession in the male line, if a widower with no son but a daughter marries again and has only a daughter, his property would be divided equally between the two daughters, unless a male child had been born to either wife, when even if it lived only half a minute the whole of the property would go to the sister of this male infant as heir of her brother (*possessio fratris*).

At a later age this question may occur with reference to malformed individuals as to their (1) education whether as a boy or girl, (2) marriage as a man or woman, or (3) right to vote as a man.

In such cases the sex may be very difficult to determine. No definite rules can be laid down; each case must be decided on its own merits, following the legal rule that the individual is to be of that sex which most predominates.

Essential tests of sex in adults.—These are—

1. Possession of a *testicle* accompanied by emissions of fluid containing spermatozoa—that is the strongest possible evidence of a male (but see case of Catherine Hohmann, p. 39).
2. Possession of an *ovary* accompanied by periodic hæmorrhages from an opening about the genitals is the strongest evidence of a female. The uterus, vagina, and breasts are merely incidental appendages.
3. In the absence of the above two characters, the presence of a *uterus* or a second opening behind that leading into the bladder indicates a female.

4. The general configuration of the body when it agrees with these local indications may be considered confirmatory evidence, but if it disagrees it should be disregarded.

Local examination should include, as far as possible, the internal genitals by bimanual and rectal palpation if necessary.

In infants a consideration of the morphology and development of the sexual organs is of assistance, as these abnormalities are due to faulty development in the fœtal stage during the differentiation of the sexes.

In the normal female there is, so to say, an arrest of development in the middle line below the genital tubercle or clitoris, the homologue of the glans penis, thus forming the entrance to the vagina, and the lateral cutaneous folds do not coalesce but remain separate and form the labia majora In the normal male the genital folds meet and coalesce in the middle line below to form the scrotum and corpora spongiosa and cavernosa and above to close over the urethra as far as the glans to form the penis. If the genital folds do not unite, the urethra of the male remains open, constituting *hypospadias*, which simulates to some extent the female organs, especially if the testicles have not descended. If in the female there be excessive lateral union and growth of the clitoris the condition may stimulate the male.

The chief homologous parts in the male and female are :—

Male.	*Female.*
Glans penis	Clitoris.
Prepuce	Nymphæ.
Scrotum	Labia majora.
Sinus pocularis	Uterus.
Vas deferens	Ducts of Gaertner.
Gubernaculum testis	Round ligament.
Testicle	Ovary.

The abnormal variations arising from faulty development in these organs which may mask the sex are divisible into :—

True Hermaphrodites { Where the internal sexual organs of both sexes are present.

False Hermaphrodites or *Pseudo-Hermaphrodites* { Where the abnormalities are confined to the external organs :—
Androgyni, or womanly men, whose male organs resemble those of the female.
Androgynæ, or manly women, whose female organs resemble the male.

Androgyni have, as the most common condition, *hypospadias*, so called from the urethra opening below the small imperforate penis. In *epispadias* there is deficiency of the anterior wall of the bladder, so that the ureters open externally above the short imperforate penis. In both of these conditions the testicles may not have descended or may exist as a tumour in the groin (*cryptorchid*). In *Androgynæ* it is usually a case of enlarged clitoris with a prolapsed uterus, the fissure of which is transverse, whilst that of the penis is vertical. In such cases, if

menstruation is found, it is a female; if a testicle or seminal emissions, it is a male.

'True' Hermaphrodites.—The old myth attributed to these beings the possession of organs of both sexes with the power of self-reproduction. No individual with such powers has ever been known to exist. This name, however, is still applied to those individuals who possess certain of the genital organs of both sexes. In the remarkable case of Catherine Hohmann, she had the sexual instincts both of a male and a female, she menstruated periodically and had seminal emissions containing spermatozoa.[1] (See also *Case b*, p. 36.)

This so-called 'true' hermaphrodism has been divided by Sir J. Y. Simpson[2] into: Lateral.—Testicle on one side and ovary on the other. Transverse.—External organs male and internal female or the reversal. Vertical or double, of three varieties.—(*a*) Ovaries with combined male and female passages; (*b*) Testicles with combined male and female passages; (*c*) Ovaries and testicles co-existing on one or both sides. The 'lateral' is considered by Watson to be the only true kind of hermaphrodism, while (*c*) ought probably to be classed amongst double monsters.

In addition to the local examination the following general characteristics should be considered:—

General sexual characters in adult:—

1. General configuration of the body. The shoulders are generally less wide than the hips in females, the reverse in males. The breasts much more developed in females.
2. Hairiness of face and pubes after puberty is greatest in males.
3. Voice is deeper in tone in male, and the *pomum Adami* more prominent.
4. Sexual instinct is assumed to be towards the opposite sex, although there are recorded instances of sexual indulgence of an inverted character (see 'Sodomy,' Chap. XVII., Unnatural Crimes).

Sex of the Dead.—When the entire body is available for examination there will be no difficulty in the great majority of cases in determining the sex, and in doubtful cases of malformed organs dissection will at once reveal the true sex. Any question with regard to the sex of a dead body usually arises when only mutilated fragments of a body or only bones are available for examination. For the identification of such bones the text-books on general anatomy should be consulted.

Sexual characteristics of the skeleton *in the female*:—

1. The *bones* are smaller, thinner, and lighter, and muscular attachments less prominent than in the male.
2. The *pelvis* is *shallower* and *wider* than in the male, which is deeper and narrower. The ilium is more expanded, sacrum more concave than the male (where it is straighter), the symphysis shorter, pubic arch wider, with edges more diverted, foramina more triangular and outlets larger than in the male.
3. The *ribs* have a greater curvature than in the male.

[1] *Med. Times and Gaz.*, June 28, 1873, and *Am. Journ. Obstetrics*, 1876, p. 615.

[2] Todd's *Cyclop. of Anatomy.*

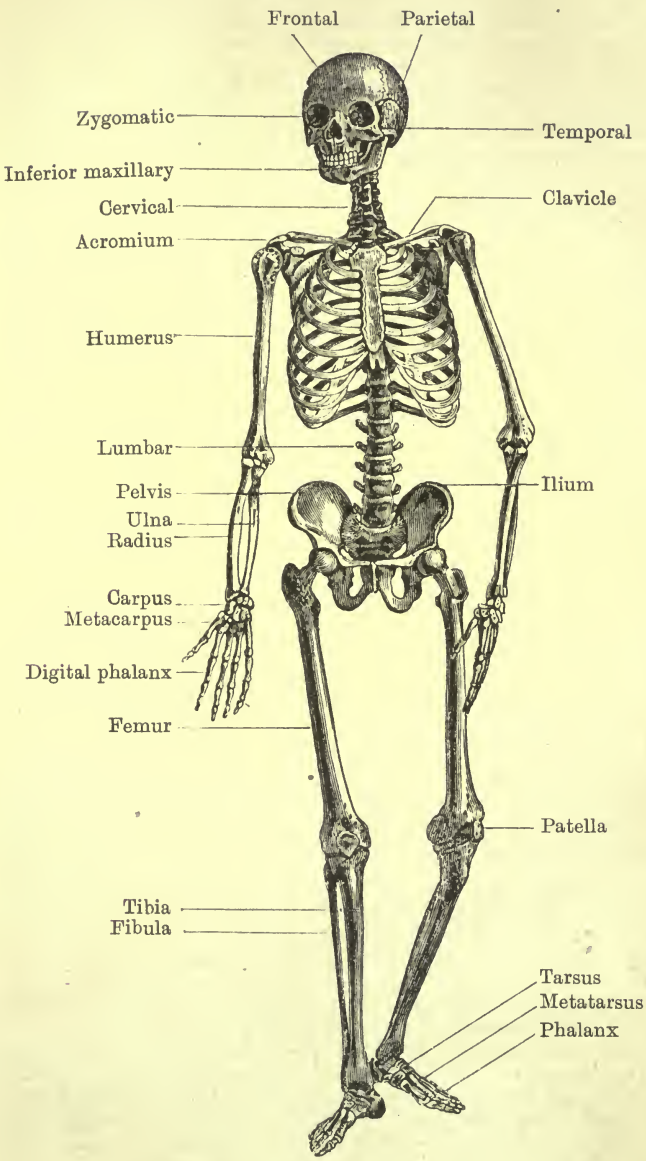


FIG. 1.—Human Male Skeleton.

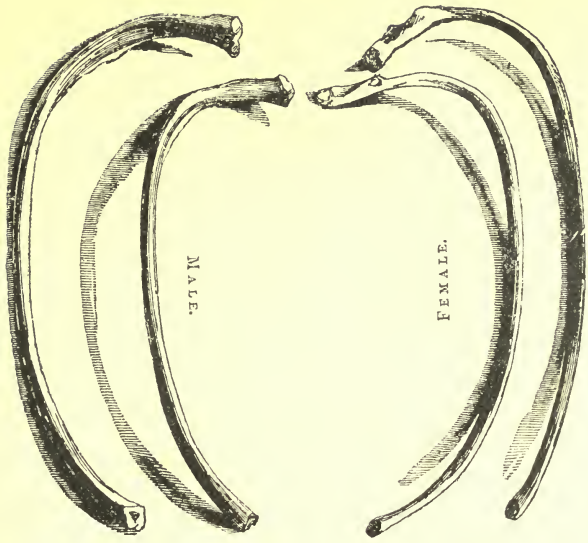


FIG. 2.—Curvature of Female Rib *v.* Male.

The average measurement of the bones (see Fig. 1) in each sex, for Europeans, are here detailed:—

MEASUREMENTS OF BONES AT DIFFERENT AGES (IN INCHES).[1]

Age.	Height.	Spine.	Circumference of skull.	Humerus	Radius.	Hand.	Femur.	Tibia.	Foot.	Pelvis. Transverse diameter of	Pelvis. Antero-posterior.
At birth	19	7·0	15·0	3·5	2·5	3·1	4·3	3·5	3·5	1·3	1·3
2 years (average) ..	27	8·5	17·7	4·7	3·6	3·1	6·2	5·1	3·6	2·2	2·2
4 to 6 years (average)	35	11·8	18·0	6·6	4·8	4·1	9·1	7·1	5·1	2·5	2·5
8 to 12 years (average)	43	12·8	18·8	8·3	6·0	5·1	11·4	9·4	6·4	3·1	3·1
15 years .. Female	55	17·0	19·0	10·3	7·0	5·8	14·8	11·0	7·8	4·0	3·6
15 years .. Male ..	54	16·5	19·0	10·5	7·5	5·6	15·0	11·5	—	—	—
15 years .. Average	54	16·6	19·3	10·4	7·4	5·7	14·8	11·6	8·0	3·8	3·6
18 to 19 years Female	59	19·0	19·5	11·0	8·2	6·5	16·0	12·8	8·0	5·0	4·8
18 to 19 years Male ..	59	17·5	20·4	11·0	8·5	6·3	15·0	13·0	8·0	3·9	3·8
18 to 19 years Average	60	18·5	19·8	11·4	8·6	6·6	15·5	13·3	8·3	4·7	4·5
Adult European (average)	65	22·2	20·5	12·7	9·2	7·3	17·88	14·4	10·6	5·2	4·3

[1] From Dr. Humphrey, *The Human Skeleton.*

Age.

The determination of age may be required for the identification of an individual, living or dead, as well as for the question of criminal or civil responsibility in regard to marriage, fecundity, rape, viability in relation to infanticide, making wills, capability as a witness, employment under the Indian Factory Act, etc.

Age in criminal responsibility.—Children under the age of seven are deemed incapable of committing an offence. Children between the ages of seven and twelve in India (seven and fourteen in England) are only deemed capable of commiting offences if they have attained a certain degree of maturity of understanding (*I. P. Code, ss.* 82, 83). Sexual intercourse with a girl under the age of twelve in India is 'rape,' even if the girl consents or is the individual's own wife (*I. P. Code, s.* 377, see also 'Rape'). In England sexual intercourse with consent is a felony up to the age of thirteen, and between the ages of thirteen and sixteen, is a misdemeanour and punishable as such.[1] In India, however, the law is in practice assimilated to that of England, by the prosecution, when failing to prove a child to be under 12, often indicting the accused under *s.* 361, *I. P. C.*, for 'enticing' or 'kidnapping,' or under *s.* 373 for "buying, hiring or otherwise obtaining for prostitution or any unlawful or immoral purpose," or under *s.* 373 for "selling, letting to hire or otherwise disposing of any minor under sixteen," which make connection with a girl under sixteen an "offence"; and then the surgeon has to inquire whether the girl be under or over sixteen. Only a person over the age of twelve can give a valid consent to suffer any harm which may result from an act done in good faith, and for the sufferer's benefit (*I. P. C., s.* 90); and in cases where the act does not come within this description, the consenting individual must be at the age of eighteen or more, for his consent to be valid (*I. P. C., s.* 87).

Age-capacity to contract marriage.—According to the law of England, females under the age of twelve, and males under the age of fourteen, cannot contract marriage. In India consummation of marriage is illegal under the age of twelve, see above.

Attainment of majority.—In England majority is attained at twenty-one. Persons under this age are minors. A minor cannot make a valid will, cannot alienate his goods by deed, cannot be called upon to serve on a jury, etc. Certain

[1] *Criminal Law Amendment Act*, 1885 (48 & 49 Vict. c. 69). Section 7 of this Act also makes it an offence to abduct an unmarried girl under eighteen with intent that she should be unlawfully and carnally known by any man.

cases excepted, persons domiciled in British India attain majority on completion of their eighteenth year, except when under a guardian appointed by a court or under a Court of Wards, when the individual does not attain majority until completion of twenty-one years of age (Act IX. of 1875, *s.* 3). Legally an individual attains a given age on the first minute of the day before his birthday, *e.g.* an individual in England who, popularly speaking, will be twenty-one on the 3rd of May, will legally cease to be a minor at the end of the last minute of the 1st of May.

Eligibility for employment under the Indian Factory Act.—In England, in factories children under eight may not be employed, and children between eight and thirteen may only be employed for six and a half hours per day; and only males and females, between thirteen and eighteen, may be employed for sixty hours per week. The Indian Factories Act (XV. of 1881) provides that, in factories coming under its operation, no child under the age of seven shall be employed, and that children between the ages of seven and twelve shall not be employed for more than nine hours per day, and shall have one hour daily for rest, and four holidays per month.

Mode of Estimating Age.

The chief data for estimating the age of an individual are—(1) the teeth, (2) height and weight, (3) hair and breast development, (4) degenerative changes, (5) extent of ossification.

In the Living, age can only be estimated with any degree of certainty in the young. After adult life is reached, the age is only to be guessed at approximately, in the absence of a regular certificate of birth or a horoscope. The points to be noted are :—

(1) **Teeth.**—These yield indications of age up till the thirteenth or fourteenth year, and with the 'wisdom teeth' up to the eighteenth year. The *temporary* or 'milk teeth' usually appear in the following order :—

Temporary or Milk Teeth Eruption.

Eruptive Order.	Name.	Age.
1	Lower central incisors	6th to 7th month
2	Upper ,, ,,	7th to 8th ,,
3	Upper lateral ,,	7th to 9th ,,
4	Lower ,, ,,	10th to 12th ,,
5	1st temporary molars	12th to 14th ,,
6	Canines	17th to 18th ,,
7	2nd temporary molars	2nd year (often later)

In certain weakly children, especially those suffering from rickets, the dentition may be delayed, while in syphilis the teeth may be premature, and even present when the child is born.

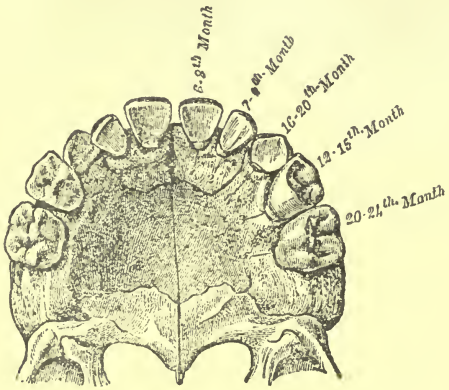


FIG. 3.—Temporary Teeth (upper jaw).[1]

The *Permanent* Teeth are thirty-two in number, 16 in each jaw. The following table by Professor A. Powell, while the police-surgeon of Bombay, gives the order of their appearance for India according to a very large series of observations by him.[2]

	Powell, for natives of India.	Saunders.	Pedley.	Gray.	Mann.
	year	year	year	year	year
First molar ..	6th to 7th	8th	6th	7th	7th
Central incisor	7th	9th	7th	7th	8th
Lateral ..	8th to 9th	10th	8th	8th	9th
Canine ..	10th to 13th	13th	11th to 12th	11th to 12th	11th to 13th
Anterior premolars or bicuspid ..	9th to 10th	11th	9th	9th	10th
Posterior premolars ..	10th to 12th	12th	10th	10th	11th to 15th
Second molar	11th to 12th	13th to 15th	12th	12th to 13th	13th to 16th
"Wisdom" ..	14th to 27th	18th to 25th	17th to 25th	17th to 21st	18th to 30th

In natives of India a few exceptions may be found to these figures, but these exceptions will be found on the precocious side, rarely at later dates.

Generally, a child of nine should have 12 permanent teeth; at ten or eleven, 24; at thirteen or fourteen he will have 28.

[1] From Macalister's *Human Anatomy*. [2] *I. M. G.*, 1902, p. 230.

In a case at Chingleput, Madras,[1] the age was decided wrongly to be between twelve and thirteen because the permanent second molar teeth were ready to come through. In advanced

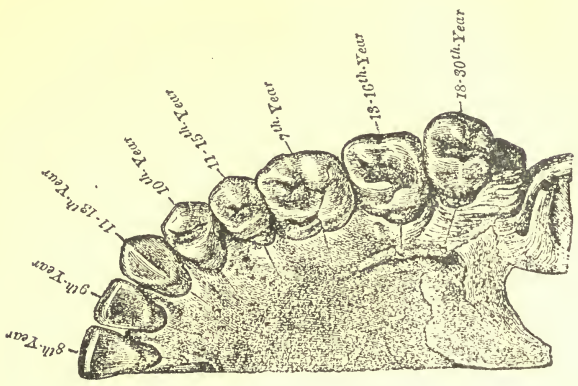


FIG. 4.—Permanent Teeth.[2]

life the teeth become worn down and discoloured, and more or less are lost.

Dr. Powell notes that :—The first molars appear with great regularity in the sixth or seventh year. Of forty-one children, aged seven, all had their first permanent molars. The central incisors appear during the seventh, the lateral at the eighth or ninth year. All nine-year-old children, natives, Jews and Parsis, had all the incisors permanent. Of ten Europeans aged nine, one girl had not shed her lateral milk incisors. The canines showed greater variation in the time of eruption. They usually appear during the eleventh or twelfth year. I have seen permanent canines in a child of nine. The anterior bicuspids appear in the ninth or tenth, the posterior from the tenth to the twelfth year. The second molars come with great regularity in the eleventh or twelfth year. They may appear earlier, but *I have never seen a Hindu or Mussulman child of twelve without second molars.* I have seen two Parsis, aged $12\frac{1}{4}$, without permanent second molars. I have seen wisdom teeth in Hindu children aged $13\frac{2}{12}$, $13\frac{4}{12}$, and $13\frac{9}{12}$. A few extraordinary irregularities may be found, but such freaks do not invalidate the general rules. I have known a European cut a wisdom tooth at thirty-six. Ackery quotes a case of temporary molars retained at 63, and Salter quotes a case of the same teeth being retained at 65.

To distinguish the permanent from the deciduous or temporary teeth is not always easy. Professor Powell gives the following directions :—

Taylor says the milk teeth are smaller than those that replace them. How is the surgeon to compare? This is not true of the deciduous molars. These are usually larger than the bicuspids which replace them.

[1] J. Short, *Madras J. Med. Sc.*, 1862, p. 227.
[2] From Macalister's *Human Anatomy.*

The anterior milk teeth are vertical, the permanent are usually inclined somewhat forward. The crowns of the milk teeth are of a white, china-like colour as compared with the ivory white of the permanent. The junction of the crown with the fang of the milk tooth is often marked by a ridge which is not seen in the permanent. 'Mercurial' teeth and Hutchinson's teeth must be of the permanent set.

2. **Height and weight.**—There are no special Indian observations on the relations of height and weight to age. The following table is based on data in England, where the average height is slightly more than in India.

Males.			Females.		
Age last birthday.	Height. ft. in.	Weight. st. lb.	Age last birthday.	Height. ft. in.	Weight. st. lb.
1	2 9½	— 18½	1	2 3½	—
2	2 9¾	2 4½	2	2 8¼	1 11¼
3	3 0¾	2 6	3	3 0¼	2 3½
4	3 2½	2 9	4	3 2¼	2 8
5	3 5	2 12	5	3 4½	2 11
6	3 8	3 2½	6	3 6¾	2 13¾
7	3 10	3 7¾	7	3 8½	3 5½
8	3 11	3 13	8	3 10½	3 10
9	4 1¾	4 4½	9	4 0¾	3 13½
10	4 3¾	4 11½	10	4 3	4 6
11	4 5½	5 2	11	4 5	4 12
12	4 7	5 6¾	12	4 7½	5 6½
13	4 9	5 12½	13	4 9¾	6 3
14	4 11¼	6 8	14	4 11¾	6 12¾
15	5 2¼	7 4¾	15	5 1	7 8¼
16	5 4¼	8 7	16	5 1¾	8 1
17	5 6¼	9 5	17	5 2½	8 3½
18	5 7	9 11½	18	5 2½	8 9
19	5 7¼	9 13½	19	5 2¾	8 12
20	5 7½	10 3¼	20	5 3	8 11½
21	5 7½	10 5	21	5 3	8 10
22	5 7½	10 7	22	5 2¾	8 11½
23	5 7½	10 7½	23	5 3	8 12
24	5 7¾	10 8	24	5 2¾	8 9
25–30	5 7¾	10 12¼	25–30	5 2	8 8
30–35	5 8	11 6	30–35	5 1	8 9

The weight slightly diminishes in old age. English children attain half their adult weight at about 12 in case of boys, and under 11 in case of girls; as in this table.[1]

	Males.		Females.	
Age.	Height in inches.	Weight in lbs.	Height in inches.	Weight in lbs.
8 years	46·66	55·08	46·73	52·82
9 ,,	49·21	60·02	48·63	56·53
10 ,,	51·00	65·29	50·07	61·19
11 ,,	52·87	71·01	53·66	68·00
12 ,,	54·05	75·00	54·41	75·95

[1] Dr. Bridges, *Memo. on prison diets*, calculated from children in non-factory districts.

The average weight of Indian children at birth has been estimated at 5½ lbs.[1]; that of English children at birth at 6½ lbs., and during the first year after birth about one pound is gained each month.[2] Of adults the average height and weight in the majority of Indian races is lower than that of Europeans. Buchanan gives the average weight of a Bengali at 109 lbs. Lewis gives under 110 lbs. as the average weight of N.-W. Provinces men. Buchanan's formula for calculating the weight for the height is: Taking 5 feet as equal to 100 lbs., add 3 lbs. in weight for every full inch above that, *e.g.* 5 ft. 6 in. = 100 + 3 × 6 = 118 lbs. In men over 5 ft. 8 in. add 4 lbs. for each inch.

For Europeans.—Average height, without shoes, and average weight, with clothes, of all classes (town and country) of the general population of Great Britain (from the report of the Anthropometric Committee, 1883). This table shows: (1) Growth is most rapid during the first five years of life, the *rate* of growth being about the same in both sexes, girls being a little shorter and lighter than boys. (2) From 5 till 10, boys grow more rapidly than girls. (3) From 10 to 15, girls grow more rapidly than boys. At 11½ to 14½ they are actually taller, and from 12½ to 15½ actually heavier than boys. (4) From 15 to 20, boys begin again to increase more rapidly than girls, and complete their growth at about 23. (5) After 15, girls grow more slowly, and practically reach their full height and weight at 20. During childhood and adolescence increase in weight is more marked in the winter, and increase in height in the summer.

3. **Hair** on pubes and armpits. This growth begins about ten or eleven years of age, and in boys about fifteen to eighteen is attended by deepening of voice.

4. **Breast development** in girls.—This varies greatly in time. In native girls the average age of puberty is twelve to thirteen (see Chap. XI.). But even women of twenty sometimes have not menstruated; and Dr. Powell cites a case of a child, aged four, who had a discharge of blood from the vagina every six or eight weeks, and the labia were large, and the breasts as large as the halves of a moderate size orange.[3] It is accepted as a good defence in England in cases of alleged rape when consent is admitted or proved that the judge or jury is satisfied that the girl looks sixteen, and might have been supposed by the accused to be sixteen years of age, irrespective of her actual age.

4. **Degenerative changes.**—Wrinkles, grey hair, *arcus senilis*, which is rare before forty, change in angle of the lower jaw. The angle of lower jaw, which is obtuse in infants, becomes

[1] Harvey, *loc. cit.* [2] According to Tidy.
[3] *I. M. G.*, 1902.

nearly a right angle in young adults, and in advanced old age becomes again obtuse and shallow, through absorption of the alveolar portion.

5. **Ossification.**—Although this is less easily and certainly observable in the living than in the dead, the *Roentgen rays* enable it to be observed in the former, and it is of especial importance in charges complementary of rape where the surgeon has to inquire whether the girl be under or over sixteen.

For points of Ossification see table. The epiphysis at the knee-joint unites at the sixteenth year and not the seventeenth to the twenty-fourth as stated in the anatomy books.[1] The external condyle of the humerus about 13th or 14th year.[2] Internal condyle 17th or 18th year; olecranon, 16th year.[3] Head of the radius *unites with the shaft* about the 13th to the 15th year. The centres of the acromion, the border and lower angle of the scapula, two in the coracoid process appear between the ages of fourteen and sixteen. These latter are difficult to observe by the X-rays. The pisiform bone in children over twelve usually shows ossification. Its absence is strong evidence that the child is under twelve.

Age in the Dead.—Here, in addition to the foregoing points regarding dentition and height-weight, it is possible to make more extensive use of an examination of the bones for that other precise criterion of age—**the progress of ossification,** as in Ogston's table on next page.

It should be noted that:—

(1) Ossification appears in the following epiphyses at the ages stated *in years.* Before the end of the 2nd, in the heads and lower epiphyses of the humerus, femur, and tibia, and in the lower epiphyses of the ulna, radius, and fibula. At 5 in the upper epiphysis of the fibula, at 7 to 9 in the olecranon, and 8 to 10 in the upper epiphysis of the radius.

(2) Ossification appears in the bodies of the following bones at the ages (stated in years). At $2\frac{1}{2}$, patella; at 3, cuboid; at 4, trapezoid and second and third tarsal cuneiform; at 5, semilunar and carpal scaphoid; and at 12 in the pisiform bones.

(3) Bony union takes place at one year, of the posterior arches with the bodies of the vertebræ, and of the three portions of the temporal bone. At 3 years, of the odontoid process with the axis; at 4 years, of the styloid process with the temporal bone; at 6 years, of the ascending and descending rami of the pubis; at 9 years of the three portions of the os innominatum in the acetabulum; at 15 years, of the last four sacral vertebræ, and of the coracoid with the scapula; at about 25, all the epiphyses have united; and at 25 to 30, the first sacral vertebra unites with the others.

(4) *As age advances* the rib and laryngeal cartilages become ossified and the skull becomes thinned by absorption of diploe.

The above directions apply also to fragmentary portions of

[1] Dr. Carl Beck, *Journ. Amer. Med. Ass.*, 5th January, 1901.
[2] Quain: Dr. A. Powell gives 16th to 17th year.
[3] Dr. A. Powell, *loc. cit.*

a body or skeleton, in regard to which consult Dr. Humphrey's table on p. 41, from which the age may be approximately estimated from isolated bones.

THE PROCESS OF OSSIFICATION.

Age after birth.	Points of ossification appear in	Bony unison occurs between
4 months	Cornua of hyoid.	—
5 ,,	Cornicula of hyoid.	—
6 ,,	Anterior arch of atlas.	Alæ majores and body of sphenoid.
1 year	Lower end of humerus; heads of humerus, femur, and tibia; 1st cuneiform bones.	Posterior arches and body of vertebræ; portions of the temporal bone, except styloid process.
2 years	Lower ends of radius, tibia, and fibula; ends of metacarpal and metatarsal bones.	—
2½ ,,	Patella, lesser tuberosity of humerus and four smaller metacarpal bones.	—
3 ,,	Cuboid and large trochanter.	Odontoid and axis.
4 ,,	Trapezoid; 2nd and 3rd cuneiform.	Styloid process and temporal bone.
5 ,,	Semilunar; carpal scaphoid; head of fibula; ends of finger bones.	Rami and body of vertebræ dentata.
6 ,,	Proximal epiphyses of four smaller toes.	Rami of pubis and ischium.
7 ,,	Trochlea of humerus.	—
7 to 9 ,,	Olecranon and scaphoid.	The two bony points at head of humerus.
9 ,,	—	Three portions of os innominatum.
12 ,,	Pisiform.	—
14 ,,	Neck and lesser trochanter of femur.	—
15 ,,	Inferior angle of scapula.	Last 4 sacral vertebræ; coracoid and body of scapula.
15 to 20 ,,	Sternal end of clavicle, coccyx.	Shaft of femur and its epiphyses; humerus and its epiphyses.
18 to 23 ,,	—	Sphenoid and occipital; tibia and its epiphyses; 1st and middle portions of sternum; epiphyses and body of ribs.
25 to 30 ,,	—	First sacral vertebra and rest of sacrum.

Race and Caste.

It is not often that this requires to be proved, but the question might arise with reference to the dead bodies of unknown persons. Certain externals of dress and conventional

markings serve to distinguish Hindus generally from Mohammedans. The chief of these are here tabulated:—

	Mohammedans.	Hindus.
Males.	1. Circumcision marks, over 11 years of age.	1. Not circumcised.
	2. Ears not pierced, or only one.	2. Both ear lobes pierced.
	3. Crown entirely shaved.	3. Hair tuft retained when crown shaved.
	4. Callosities from prayer attitudes on forehead, tip of l. ext. malleolus patella, tuberosity of l. tibia.	4. None.
	5. Palm of l. hand and tip of little finger occasionally stained with *henna*.	5. Not so.
	6. Chapkan coat fastened on left side of chest, and may show sunburnt mark.	6. Chapkan opens on right side.
	7. No sacred thread.	7. Sacred thread in higher castes over left shoulder.
Females.	1. Not tattooed, especially between eyebrows.[1]	1. Tattooed between eyes and inside wrist, especially lower castes.
	2. Ears pierced numerously along helix with silver rings.	2. Ears pierced in few places.
	3. Nose-ring through septum.	3. Nose-rings through left ala.
	4. Shoe marks probable.	4. Shoes not worn, toes wide-spread.
	5. Palm, soles and nails tinted with brown *henna* or *mehindi*.	5. Stained with carmine *aultha*.
	6. Sari worn double.	6. Sari worn single by married, except in E. Bengal.
	7. Trousers usually.[2]	7. No trousers.
	8. No vermilion or hair-parting.	8. Vermilion on hair-parting in married.
	9. No iron-wristlet.	9. Iron-wristlet on left wrist in married in Bengal.

The best test of race is found in the measurements of the head, and of these the easiest to take and one of the most important is the *cephalic index*. This is the ratio between the maximum length and maximum breadth of the skull, thus: $\frac{\text{Breadth transversely} \times 100}{\text{Antero-posterior length}}$ = Cephalic Index. A skull is '*dolicho-cephalic*' or '**long**-headed' when this index is between 70 and 75·9, '*mesaticephalic*' or '**medium**' long-headed from 75 to 79·9, and *brachy-cephalic* (the Mongolian type) or '**round**'-headed from 80 upwards. The skull of the fair Anyans and the dark aboriginal Dravidian tribes are both 'long-' or 'medium long-'

[1] Except proselytized Bengali Mohammedans.

[2] A Parsi woman wears trousers and sacred thread around waist like male Parsis.

headed; but in the case of the Anyan, or type in which the Anyan blood predominates, the long-skull is broad-browed, whereas the Dravidian, though also long and usually relatively longer than the Anyan, is narrow-browed. Thus, whilst Rajputs, Brahmans and Kayasts of Bengal have skulls with a cephalic index averaging respectively 76·7, 78·7, 78·2, and Dravidian tribes and castes average 74·8 to 78, in the former case the brow is broad, giving a wider skull with larger brain in comparison to the narrow skull of less brain capacity of the Dravidian and Dom.

Racial differences in skeleton.—Sir R. H. Charles, I.M.S., has shown[1] that it is possible to differentiate Oriental from European skeletons by means of peculiarities in the vertebral column, pelvis and lower extremities, the result of changes in the bones brought about by the different modes of sitting. The Oriental in India sits habitually in a squatting posture on the ground, or on a cushion, and not on a chair. His body, when thus seated, leans much more forward than in the chair position of the West, and the effect of this habit during many centuries has been to cause an alteration in the bones.

The importance of being able to distinguish the skeleton of a European from an Indian may be useful at times, such as when a British soldier has disappeared from cantonments, and a skeleton is brought forward which is believed to be that of the missing man.

Spinal Column.—As a rule the body of a Punjabi lumbar vertebra is *thicker behind than in front* . . . and as the type matures with age, the excess of the posterior over the anterior becomes more pronounced. In the female only is the anterior measurement greater than the posterior. The total posterior diameter of the five lumbar vertebræ, I have found exceeded the anterior by 19 mm. in one case. Generally the difference is 8 mm. in favour of the posterior. Amongst European skeletons, Sir William Turner states there is a variance of 5·6 mm. in favour of the *anterior* surface. The 5th lumbar vertebra is only exceptionally wedge-shaped as in the European. Up to the age of 12 years none of the typical changes have taken place, and it is probable they occur in the epiphysial area, and that it progresses from puberty to 25 years of age eventuating in the fact that the *deepest* part of the centrum of a lumbar vertebra is behind, and not as in the European in front.

The lumbar curve is straight or very slightly convex. The mean general lumbar index of some recent vertebral columns I found to be 106·8. Sir Wm. Turner quotes 96 as the index for the European lumbar curve. The accessory processes of the 5th *lumbar* are frequently very largely developed, and often articulate with the alæ of the sacrum.

[1] The identification of European and Oriental skeletons by Major R. H. Charles, I.M.S., *Ind. Med. Congress Trans.*, Calcutta, 1894.

The auricular surface of the sacrum I found in 78·7 per cent. to be formed of only two vertebræ, the first and second. European sacra have this surface formed from three vertebræ, according to Professor Macalister.

Acetabulum.—1st, in natives of India the ischial portion of the *facies lunata* is very large. The rim of the acetabulum here is very prominent, the groove for the obturator externus below it is consequently deep.

2nd, in the extension forwards and widening out of the lower horn of the facies lunata whereby the cotyloid notch is, as it were, partly bridged over instead of being an irregular open space. It looks as if the transverse ligament were ossified on its ischial side.

3rd, the cotyloid notch, which in the European os innominatum is as a rule open, presents in all well-marked Indian bones the characteristic of being arched over by the forward and upward prolongation of the inferior cornu of the facies lunata. The superficial boundary of the cotyloid notch in the European consists of the transverse ligament alone; the same boundary in the Indian consists of bone (part of the ischium) plus the transverse ligament.

Head of the Femur.—The articular area is of greater extent relatively and absolutely than that of an European bone. The surface is specially prolonged to adapt itself to the modified facies lunata of the acetabulum during extreme flexion and partial abduction, and during semi-flexion and extreme abduction occurring in the hip-joint in the squatting and satorial postures. The **neck of the Femur** is longer relatively than in the European. The upper surface of the internal condyle of the femur is partly articular. This is not so in the European, where it is merely rough for the internal head of the gastrocnemius. It is due to the power of extreme flexion possessed by the Oriental knee-joint.

Head of the Tibia is set on the shaft very obliquely. An Oriental tibia can be easily held by the finger and thumb when the internal tuberosity is grasped behind by them. The upper surface of the internal tuberosity slopes considerably downwards and inwards; it is never flat as in the European bone. The external tuberosity of the tibia has its condylar surface convex from before backwards, and the articular area is well prolonged downwards posteriorly. The upper part of the tibial diaphysis is commonly directed obliquely backwards. On the anterior margin of lower extremity of the tibia, a facet will in the great majority of cases be found on what is the ligamentous area of the European bone. In upwards of 17 per cent. of tibiæ a second facet on the same border, but occupying a more internal position, will be seen. Both these articulate with corresponding articular areas on the upper surface of the neck of the Astragalus.

The Astragalus contrasted with the European differs considerably. The outer margin of the neck is much thinner than in the European bone—markedly so. On the head there is a greater prolongation of the articular surface, both internally and externally relatively to the size of the bone, than in the European specimen. The under surface.—In the European bone the deep concavity or articulation with the large convex facet on the upper surface of the os calcis is bounded generally by two sharp non-articular margins. In Oriental bones the outer margin is frequently articular on its inferior aspect, as this part, when the facet exists, articulates with the upper surface of the greater process of the os calcis.

The Skull.—For practical purposes it may be assumed that most male Indian skulls, certainly those of the lower castes, have a cubic capacity

of 1360 c.c. or under, whereas European male skulls run from 1500 c.c. and upwards. The measurement of the cranial cubic capacity is easily taken with mustard seed, which is procurable in any bazaar [though the use of small shot, as in Europe, is better, especially if the skull is wet or dirty].

Bones generally.—Some points assigned by authorities as differentiating European and Asiatic skeletons are to be used with caution :—

1st.—The bones of the Oriental are smaller. It is generally so, but not always. 2nd.—The skeleton of the Oriental is lighter. An adult male European skeleton weighs about 10 lbs. 6 oz., the female weighing 8 lbs. 13 oz. A skeleton of a Panjabi weighing 12 lbs. 3 oz. is exceptional. The rule holds truer for *female* skeletons. An average Panjabi female weighs about 6 lbs. 2 oz. There is a greater difference in weight and stature between the Indian female and the European female than there is between the males of these races.

Birth-mark as Test of Race.—The presence of blue irregular patches on the lower sacral region of infants is alleged by Baelz to be exclusively found amongst persons of Mongolian race. Extensive inquiry by the Indian Government during the census of 1911 elicited that the 'Mongoloid patch' is almost universal amongst the Burmese who are typically Mongolian—the colour is generally dark blue, but varied from dark brown or reddish to pink (Burma Cens. Rept. 1911, 285). It was fairly common in Assam, Bengal, the eastern border of the Upper Provinces and Panjab, where a large leavening of Mongolian blood is known to exist. The Bombay Rept., from observations in maternity hospitals, found the patches in Hindus 25 per cent. in Bombay and 17 out of 19 in Admedabad; Goanese nearly 20 per cent., and infers that while it may be universal in Mongolian races, it is not confined to them exclusively.

Personal Marks or Peculiarities.

These may be *congenital* or *acquired*. Those which admit of being photographed should be so registered.

CONGENITAL.

These are chiefly the features, colour of the eyes, etc., deformities, and finger-prints.

1. **Features.**—Resemblance to parents or family likenesses or to photographic portraits of a missing individual may be important in the case of those claiming to be individuals who have not been heard of for years. In the case of dead bodies, putrefaction rapidly renders the features unrecognizable; in some instances, however, the features have been clearly recognized

after long interment, *e.g.* in the case of Charles I., whose body was exhumed 165 years after death.

Cases of Disputed Identity.—(*a*) The **Tichborne case.**—At the trial of this case in London in 1874, the main question was whether an individual who claimed large estates was or was not Roger Tichborne. Roger Tichborne was believed to have perished at sea twenty years previously. Some of the witnesses expressed their belief that the claimant was really Roger Tichborne; the majority, however, denied this, and believed he was Arthur Orton, a butcher, of Wapping. The following were some of the main points in the cases:—(1) It was proved that Roger Tichborne had been bled repeatedly from the arms, and once also from the ankles and temple; also that he had tattoo-marks on the left arm. None of these marks were present on the body of the claimant. (2) Comparison of the features of the claimant with a photographic portrait of the true Roger Tichborne showed the following differences: (*a*) The eyes of Roger Tichborne tended upwards from the nose at more than a right angle, those of the claimant tended downwards and therefore at less than a right angle (*see* diagram, Fig. 4A); (*b*) the ears of the

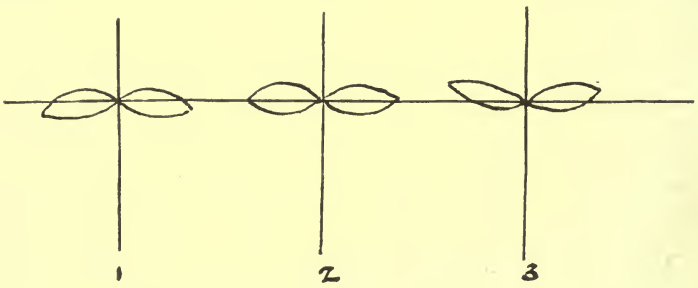


FIG. 4A.—Angle of Eyes in Identity-Cases.

In No. 2 the axes of the eyes form a right angle with a line drawn through the middle of the forehead and nose. In No. 1 it is less than a right angle, in No. 3 more than a right angle.

claimant were about one-third longer than those of Roger Tichborne; (*c*) the central groove joining the nose to the upper lip was much wider in Roger Tichborne than in the claimant. (3) The claimant was acquainted with many of the events in the life of the true Roger Tichborne, apparently picked up from various sources; he, however, (*a*) did not know the Christian names of Roger Tichborne's mother; and (*b*) could neither read nor speak French, although the true Roger Tichborne spoke French fluently.[1]

(*b*) The **Burdwan Case** of Disputed Identity.—Pratap Chandra.—The case of Pratap Chandra, the claimant to the Burdwan Raj, resembled in many respects the foregoing Tichborne case. It was tried in 1838 at Hooghly. The *rāja* of Burdwan at the beginning of last century had an only son, Pratap Chandra, who died in 1820-1821, during the lifetime of his father. Fifteen years afterwards, in 1835, a pretender appeared calling himself Pratap Chandra and claiming the Burdwan estate. He came in the garb of a *sanyasi*, and declared that he had not died as was alleged, but had been living in secret retirement and had now

[1] Guy's *For. Med.*, p. 37.

returned. His story gained considerable credence, and some of his adherents created a breach of the peace for which he was imprisoned for six months. On release from jail he was provided with funds by some of those who believed in him, and went in royal state with a large following to take forcible possession of the palace, causing a disturbance in the quelling of which three persons were shot by the military. He was indicted for fraudulently assuming the name and title of the deceased *rāja*. The death of the real Pratap Chandra was testified to by the native doctors who treated him, and other persons who saw him die of fever, and who were with the corpse until it was cremated, also the priests who performed the *sradh* ceremonies. The face of the corpse was uncovered and then touched with fire three or more times, and the fire having burned the corpse to ashes in the presence of two or three thousand spectators, it was impossible that the body could escape. The identity of the claimant was rejected by Mr. H. T. Prinsep, Secretary to the Government of India, and several others who had known the Pratap Chandra. Whilst General Allard, Major Marshall, Dr. Scott, Civil Surgeon of Burdwan, Dr. Halliday and others believed he was the real Pratap. The prosecution alleged that he was Kristo Lal, son of a priest, formerly resident of Burdwan. Several witnesses testified to the claimant being the latter person, also the prisoner's voice and manner were quite different from those of Pratap, but his features, especially in the shape of the nose and the colour of the eyes, resembled a picture of Pratap. Major Marshall identified him as Pratap by certain marks, though the nose of the young *rāja*, twenty years before, was "rather fuller and smoother, and the outline not so distinct" as the prisoner's at present. The Danish Governor of Chinsurrah, who was well acquainted with Pratap, identified prisoner as the real prince by certain scars, namely, a slight mark behind the right ear occasioned by the glazed string of a kite. A mark between the shoulders caused by the bite of a vicious horse, a mark on the knee, and a scald mark, the size of an eight-anna piece, on left hand. The prisoner possessed all these marks. The judge held that the case was proved against prisoner and recommended that he be sentenced to three to five years' imprisonment. The High Court (Nizamat) sentenced him to a fine of Rs. 1000 for having assumed the name of Pratap Chandra. He died in obscurity in 1856.—Abridged from *Celebrated Trials*, by J. Goshal, 1902.

(*c*) Martin Guerre's identity.—In the second half of the sixteenth century, Martin Guerre, then a young man of twenty, absconded from his village in Languedoc, under fear of being charged with theft, leaving behind him his young wife and infant son. Martin Guerre, it was afterwards proved, enlisted as a soldier, and became extremely intimate with a comrade of bad character named Arnauld de Tilh (or Dutille). Eight years after Martin Guerre's disappearance from his home, Arnauld de Tilh appeared there, represented himself as Martin Guerre, and was at once accepted as the latter by all Martin Guerre's relatives, including his wife. The impostor, mainly through his having become acquainted with all the true Martin Guerre's secrets, was able to carry on his imposture with success for several years. At the end of that period a quarrel arose between the impostor and Martin Guerre's uncle, when the latter denounced the former, who was put on his trial. At the trial of 150 witnesses, forty swore that the accused was Martin Guerre, and fifty that he was not; the remaining sixty were in doubt. Martin Guerre's wife was quite satisfied that the accused was not an impostor. The trial resulted in the condemnation of the accused. He appealed. The Appeal Court found the evidence so extremely conflicting, that they were inclined to reverse the judgment of the lower Court when

the true Martin Guerre appeared. Arnauld de Tilh was thereupon condemned, and subsequently confessed his imposture. Some of the points in this case were: (1) The accused "had double eye-teeth in the upper jaw, a scar on the forehead, the nail of the left forefinger sunk in the flesh, and four warts on the right hand—all peculiarities possessed by the true Martin Guerre." In other personal peculiarities, however, the accused differed greatly from the true Martin Guerre. (2) "Martin was a skilled fencer, which Arnauld was not; and Arnauld could not speak even a few words of Martin's native Basque language."—Guy's *F. M.*, 15.

2. **Colour of eyes, skin,** and **hair.**—In some individuals one iris differs in colour from the other. The hair resists putrefaction, hence its colour, etc., may be of special importance in the case of exhumed or greatly putrefied bodies. The colour of the hair may, however, have been altered for disguise or otherwise, *e.g.* darkened, generally by the use of metallic dyes, chiefly lead or silver compounds;[1] or rendered lighter by chlorine or hydrogen-dioxide solution, in which case the roots will be found less altered, and therefore darker than the rest of the hair. The hair is frequently dyed reddish in elderly Mohammedans.

Case.—A portion of a scalp with a tuft of red hair was held to prove the identity of a murdered indigo planter Dick in Nuddea District in 1830.—Chevers, *M. J.*, 60.

3. **Deformities.**—Such as moles, 'birth-marks' (*nævus*), hare-lip, web-fingers or toes, and additional fingers. Birth-marks may be removed by painting with carbonic-acid-ice; in the inflammation resulting the frozen tissue is absorbed, leaving the skin practically normal.

4. **Finger-prints.**—Identification by means of finger-prints has now established its claim to trustworthiness, and has become a most important branch of criminal investigation both for the detection of crime and the identification of the criminal. It has, in the Galton-Henry system, been adopted in India, England, and most civilized countries throughout the world, and has superseded the French anthropometric system of ear-measurement of Bertillon, and it is legalized under the Indian Evidence Act, all emigrants signing contracts under the Emigration Act.

Finger-prints appear to have been first practically utilized for the identification of individuals by Sir W. Herschel, of the Indian Civil Service, who introduced it into the Hugli district of Bengal in 1877 for the purpose of identifying illiterate Indian coolies and the executants of documents for registration, in order to detect false impersonation, which

[1] For the detection of these the hair may be digested in dilute nitric acid, the acid liquid evaporated to dryness, and the usual chemical tests applied to a solution of the residue; or the hair may be incinerated and the metal sought for in the ash (see detection of lead in organic mixtures).

was prevalent in the law courts.[1] The materials and experience thus gained were utilized by Sir Fancis Galton in 1888, in his scientific study of the subject; but it remained for Sir E. Henry (Inspector-General of Police, Bengal) to take up the Galton formulæ and invent a relatively simple ideal system of classification on a numerical basis.

The Galton-Henry system is now in general use in India as a check against false impersonation in the case of all subordinate pensioners, civil and military, *pardah* or *zenana* ladies, for medical certificates and attestation in many branches of public business, under the undesirable plague regulations, and for Mohammedan pilgrims to Mecca, to prevent the re-employment of discharged men, and innumerable other purposes of identification. Whilst the record is of admitted efficacy for the proof or disproof of identity where the person in question is accessible

A B

FIG. 5.—Finger-print impressions (after Sir E. Henry).
A, '*plain*.' B, '*rolled*' impression of the same finger.

or has given his mark on a previous occasion, no objection can be offered to this method on the score of caste or religion, or rank in society or sex, as there is no prejudice to be overcome in obtaining it.

The persistence of the specific details of the ridges forming the patterns of the finger-markings has been proved by Galton to portend throughout the whole period of the individual life. Those found on the new-born babe are traceable on the fingers of the same person in extreme old age, and are only effaced when decomposition has set in after death. Galton concluded

[1] *Nature*, XXII., p. 605.

that "there appear to be no bodily characteristics other than deep scars and tattoo-marks comparable in their persistence to these markings."

The characteristic markings on the skin over the balls of the fingers are the curved lines termed *papillary ridges*, not the lines called creases. These ridges are studded with minute pores, the mouths of the ducts of the sweat-glands, which appear on the imprint as fine dotted lines. A cicatrized cut (see Figs. 6 and 7) or deep ulcer leaves a permanent mark,

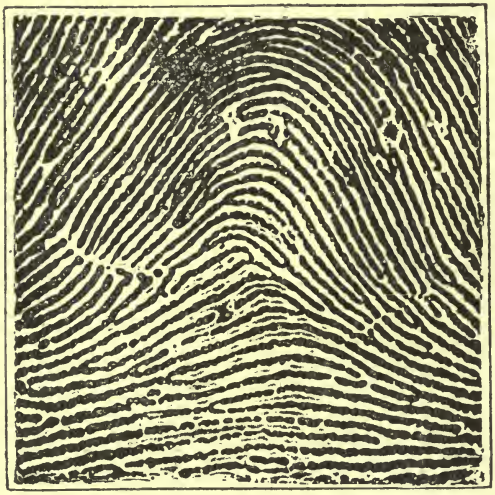


FIG. 6.—Magnified finger-print, '*Arch*' pattern (after Henry).
N.B.—The white transverse lines across the ridges are cicatrized cuts.

which shows on the paper imprint as a white space or line. These marks have to be distinguished from possible accidental creases in unskilful taking of impressions. In comparing impressions the examiner seeks for similarity or dissimilarity in the type and details of the ridges of the patterns; and if his conclusions therefrom are corroborated by coincident creases his task is so much the easier. The lines or papillary ridges are constant and invariable in the same individual, and no two separate individuals exhibit patterns which exactly or entirely correspond. As, however, single digits of different persons have been found to correspond closely in details, great caution is needed where only a single digital imprint is available for comparison,[1] and it is now customary in criminal cases to take

[1] Dr. Garson, *Trans. Med. Leg. Soc.*, 1906, 16, etc.

the impressions of all the fingers. A 'rolled' impression, recording the pattern of the whole ball of the finger, is much more perfect and desirable than a 'plain' one (see Fig. 5, p. 57), which is only partial.

Directions for Taking Finger-prints.[1]—Take (1) ordinary white paper not too highly glazed; (2) some ordinary printer's ink; (3) a roller for spreading it, consisting of a wooden cylinder 3½ inches long, one inch diameter, over which a piece of indiarubber tubing has been tightly stretched; (4) a piece of flat tin as a slab; (5) a pointer, which could be a penholder-handle with a needle let in at one end, to count the ridges; (6) a lens to assist in the counting. The ink, roller and slab must be kept

FIG. 7.—Magnified Finger-print, '*Loop*' pattern (after Henry).
N.B.—The white transverse lines across the ridges are cicatrized cuts.

scrupulously clean and free from dust, hairs, or grit; the ink should be kept in a closed bottle, and the roller wrapped in clean, oiled paper, and all old ink wiped off the slab.

For a '*rolled*' impression, the bulb of the finger is placed upon the tin slab, over which the *thinnest* possible film of printer's ink has been spread, the plane of the nail being kept at right angles to the plane of the slab, and the finger is then turned over until the bulb-surface, which originally faced to the left, now faces to the right. By this means the ridge-surface of the finger between the nail boundaries is inked, and, by pressing it lightly upon paper in the same way that it was pressed upon the inked slab, a clear rolled impression of the finger surface is obtained. Care must be taken to have a very small quantity of ink in the thinnest film, not to press the finger too heavily on the inked slab, or subsequently too heavily on the paper, otherwise a blurred or imperfect impression results. A '*plain*' imprint is obtained by placing the bulb of the finger upon the inked slab, and then impressing it on the paper without any turning movement.

[1] For full details see *Classification and Uses of Finger-prints*, by Sir E. R. Henry, 4th ed., London, 1913, 20, etc.

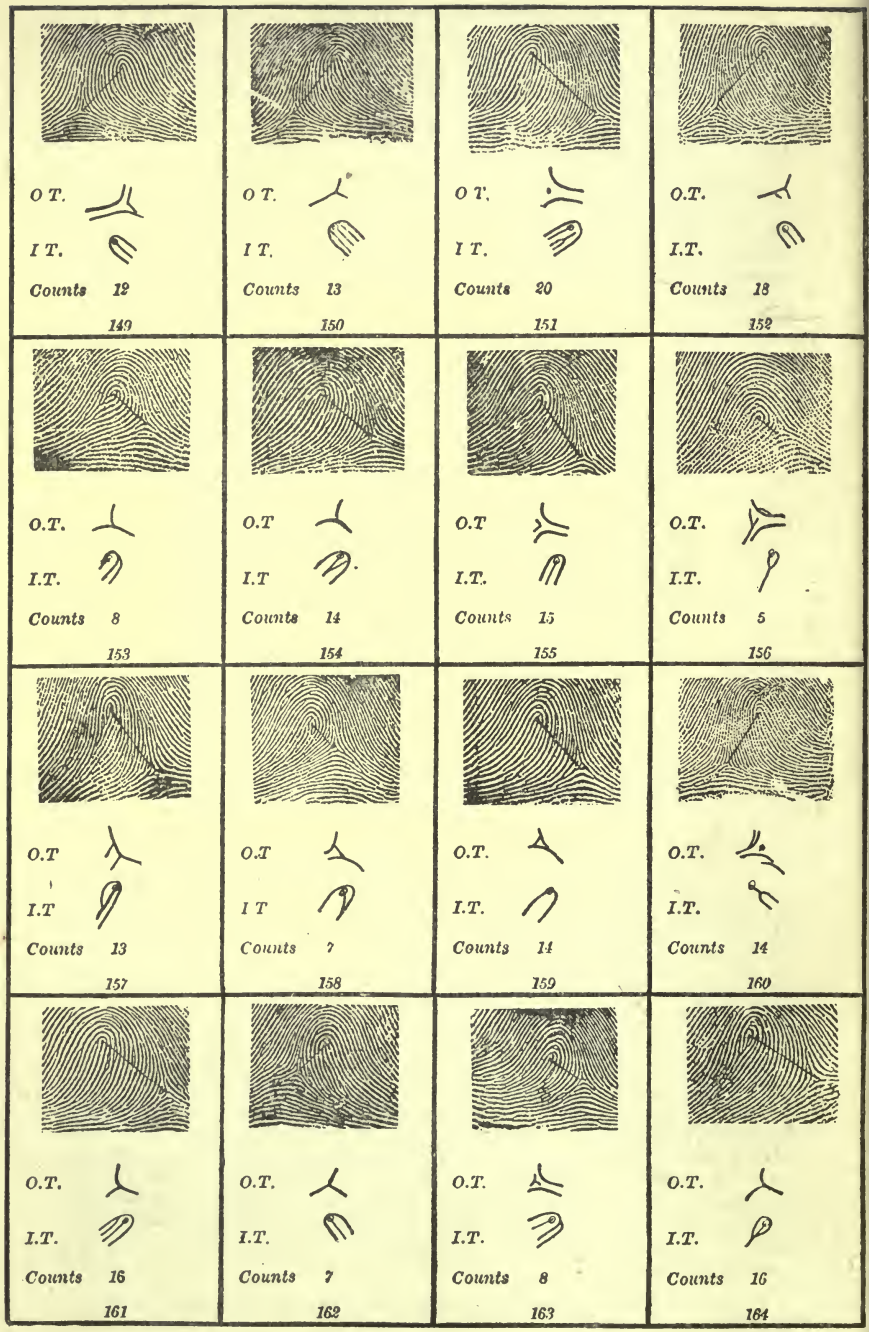


FIG. 8.—Counting the Ridges (after Henry).

O.T. = Outer terminus. *I.T.* = Inner terminus.

Preparation of Finger-print Exhibits.—Crime investigators require to know how to secure the evidence of finger-prints at the scene of crime. A smooth article is likely to retain imprints if touched, whilst a rough surface is of little value. Any finger-print found, which is obviously not that of a resident of the house or a previously arrived police official, should be examined with a lens to ascertain whether it possesses sufficiently defined detail to photograph, as the absence of sufficient detail may render it useless. A special camera and procedure for this purpose used by the London police authorities (see Henry, *op. cit.*, 106, etc.) ; slow plates and a developer likely to produce the maximum contrast are used. The results are then presented alongside the finger imprint of the suspected person, and a sketch comparing the characteristic resemblances, as in Fig. 9.

Latent Finger-prints.—It is important to warn the police and others not to handle weapons, etc., which might have upon them, if left to skilled hands to examine, valuable silent testimony, as apparently invisible marks may be made visible. *Development of apparently invisible finger-prints.*—Dr. J. G. Garson's process is to dust an impalpable powder, light or dark, according to the colour of the surface suspected (finely powdered plumbago or grey powder), over the surface supposed to have been impressed by the papillary ridges of the fingers in their natural state as regards moisture. The powder will adhere to the papillary lines' impress, and can be examined with a lens, or permanently recorded by photography.[1]

Classification of Prints for Criminal Work.—This requires the services of a practised expert. The patterns of the papillary ridges fall into three main types, and a fourth or mixed one, thus—' arches,' ' loops,' ' whorls,' and ' composites.' The ' arches ' differ from the ' loops ' in having the ridges running from one side to another without exhibiting any backward turn (see Figs. 6 and 7, pp. 58, 59). In the impressions of the four types there are fixed points which serve useful purposes, termed the ' *delta* ' or ' outer terminus,' and the ' *point of the core* ' or ' inner terminus.' The core of the loop may consist of an even or an uneven number of ridges, termed ' rods,' or the summit of two rods may be joined to form a ' staple.' The arches may be ' tented,' etc., the loops ' pocket,' ' twinned,' etc. The relative frequency of the various patterns is, approximately—Arches 5, Loops 60, Whorls 35 per cent. The greatest variety of pattern is found in the forefinger, and the least in the little finger. In the Galton-Henry classification Arches are classed with Loops, and the Composites with the Whorls, so that only two divisions of patterns have to be dealt with, and these are recorded on a chessboard-like table with 1024 squares, the number of possible combinations for the digits. The actual formula of each pair of digits is recorded in the form of a fraction, of which the upper letter denotes the pattern of the first digit of the pair, and the lower that of the second digit; thus the right thumb and forefinger becoming respectively a loop and a whorl, is indicated as $\frac{l}{w}$, and a complete formula might be as follows :—

$$\frac{l}{w}, \frac{l}{l}, \frac{w}{l}, \frac{l}{l}, \frac{w}{w}$$

which, converted into figures, might be—

$$\frac{0}{16}, \frac{0}{0}, \frac{4}{0}, \frac{0}{0}, \frac{1}{1} = \frac{5}{17}$$

[1] *Trans. Med. Leg. Soc.*, II., 1905, p. 115.

which indicates for record the compartment of the intersection of the 5th vertical row with the 17th horizontal row, if the respective rows are numbered 0 to 31 (see Fig. 9, D, also Fig. 8, for ridge-numbering of an ordinary Loop). First the line SB joins the two terminal points, 'inner' and 'outer' terminus. If the ridges which cut the line SB are *counted* they will be found to number 17, so this Loop is termed a Loop with 17 ridges or '*counts*,' and if it is the impression of a 'right-hand finger' it is an '*ulnar*,' or if left hand a '*radial*' Loop.

In presenting finger-print evidence in court it is necessary to employ an expert to explain the technical details of the exhibits to the court and jury. For India, the Central Finger-proof Bureau at Simla offers the best authority.

Cases.—(*a*) **Murderer detected by thumb-prints.**—The accused, Man Singh, Kayasth, a *daftari* at Muttra, was convicted of the murder of Durga Pershad. The case turned mainly on the identification of the accused by his thumb-mark. Durga Pershad was apparently a man of some means, but lived entirely alone. He lived a penurious life, without even a permanent servant in the house. His food was prepared by a Brahman woman, who attended for that purpose twice in the day. On the evening of the 4th of March, 1901, this woman prepared his food, and when going away left sitting at his house two men, one of whom she identified as the appellant, Man Singh. She knew Man Singh, because he was a constant visitor of Durga Pershad. Nothing suspicious was heard that night. In the morning, as no answer could be obtained from Durga Pershad's apartments, the police were sent for, and when they effected an entrance, they found the old man lying dead in his court-yard, which was covered with blood. The body was marked with twenty-four incised wounds. The old man had apparently been first attacked in his bed and sitting-room, for the matting on the floor near the bed was drenched with blood. His personal ornaments, etc., were gone, and no money was found in the house. All the boxes had been opened, but no ordinary clothes had been taken. But the murderer, in the words of the judge, had left a most damning piece of evidence behind him. On the ground near the body was a brass *lotah*, containing a little water, and on that *lotah*, broad and plain, was a bloody finger-print, with the whorls and ridges plainly marked. The mark was in the exact place it would be if the *lotah* were held for pouring native fashion, with all the fingers below it and the thumb on the side. The *lotah* was photographed at once. A *pugri*, out of which a piece had been torn, was also found, covered with blood. The police formed the idea that possibly the murderer, or one of the murderers, had got hurt in the struggle, and had used this bit of the *pugri* to bind up the wound. Some suspicion fell on the appellant, and on the 8th the sub-inspector examined his hand, on the back of which he found a long cut, the marks of which were visible at the hearing in the Sessions Court. In addition to the evidence of the Brahman woman, Kalki Chobe identified the appellant as one of the men who constantly used to visit Durga Pershad. Man Singh was accordingly arrested. One of the Muttra police was sent off to Allahabad with a photograph of the impression found on the *lotah*, and with the impressions of the thumb marks of several persons, including those of the accused. The impressions were examined by an expert in the Allahabad Central Office, and the impression of Man Singh's right thumb was found to correspond with the impression on the *lotah*.

Justices Blair and Burkitt, in their judgment, remarked: "The witness, who is the head clerk of the Criminal Identification Department, through whose hands, as he swears, every year thousands of finger impressions pass, swears that the thumb impressions of the appellant's right hand, which was sent to him from Muttra, corresponds exactly with the thumb impression photographed from the *lotah*. That photograph has been enlarged at Allahabad by a photographic method without being

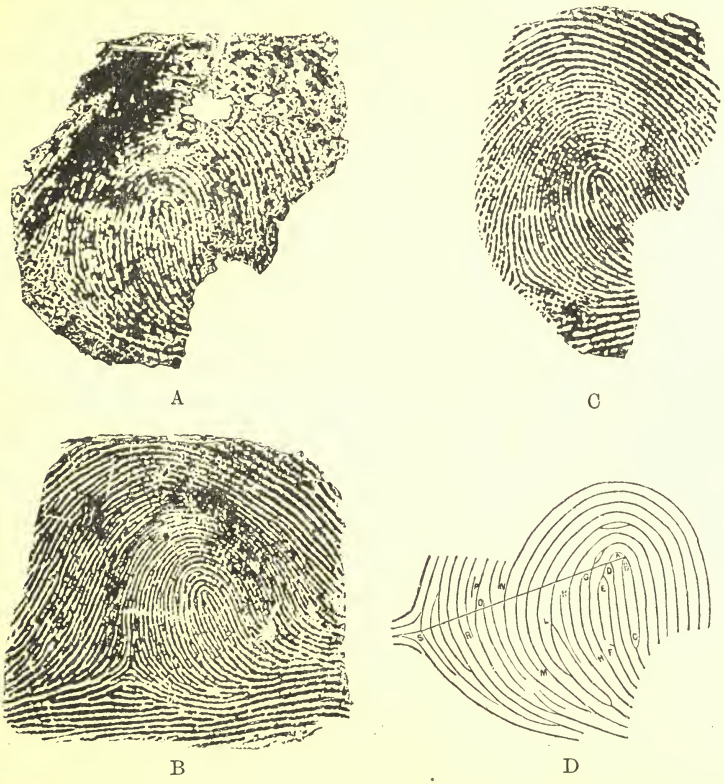


FIG. 9.—Identification of Bloody Thumb-print in Jalpaiguri Murder Case (after Sir E. Henry).

A, photo-mechanical enlargement of actual blood-print; B, same of thumb-print record in police office; C, same of fresh print; D, diagram of characteristic ridges, enlarged.

in any way touched up. The witness, in the closest detail, gives his reasons for believing that the two impressions are the impressions of the appellant's right thumb. That is evidence upon which we can safely rely." After referring to the test of this witness in the Sessions Court, already recounted in the words of the Sessions Judge, their Lordships continued: "In our opinion this evidence is conclusive of the presence of the appellant at the house of Darga Pershad on the night of the

4th March and on the morning of the 5th, when Darga Pershad was murdered. The motive for the crime is not far to seek. The appellant was in very poor circumstances. Previous to the 4th of March he was indebted to several persons in small sums of money, which he was unable to discharge. There was also a decree under execution against him. After the 5th he was in possession of money, and paid off several creditors. It is not shown to us how he came into possession of those sums after the 5th of March. The only way of explaining it is by his statement to the Deputy Magistrate that he had received Rs. 15 and a shawl as his part of the plunder. Taking all the above facts into consideration, they lead us unhesitatingly to the conclusion that the appellant took part in the murder of Durga Pershad, and may possibly have been the sole murderer. We dismiss the appeal, confirm the sentence, and order that it be carried out according to law."—*Pioneer*, June 7, 1901.

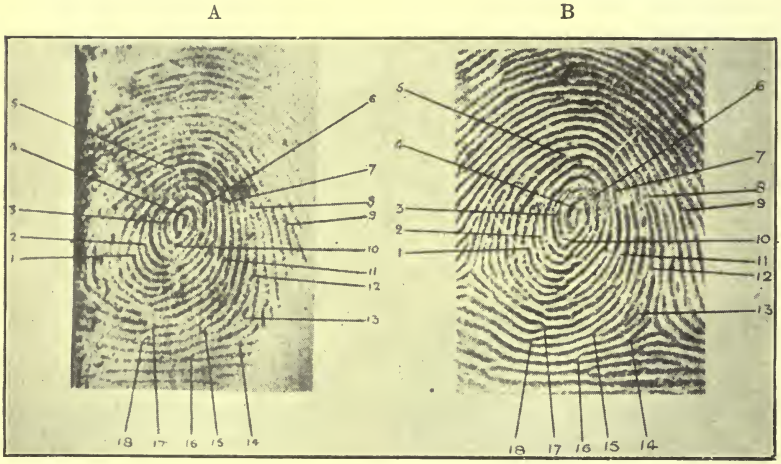


FIG. 10.—A, Photographic enlargement of mark on glass; B, Photographic enlargement of an imprint of the right forefinger of John McDermott. The characteristic points are numbered similarly in both figures (after Henry).

(*b*) **Bloody thumb-print** in murder case.—In 1889 the manager of a tea garden in the Jalpaiguri district was found lying on his bed with his throat cut, his despatch box and safe having been rifled, and several hundred rupees carried away. Amongst the papers found remaining in the despatch-box was a calendar, on the outside cover of which were two faint brown smudges, one of which, under a magnifying glass, was seen to be the impression of a person's thumb (see Fig. 9, A). This was sent to the central office of the Bengal Police. It was found to correspond exactly with the right-thumb impression of Kangali Charan (B), a former servant of the deceased, whom the latter had caused to be imprisoned for theft, and who had been released from jail some weeks before. He, in consequence, was arrested in Birbhum, a district some hundred of miles away, and brought to Calcutta, where his right-thumb impression (C) was again taken. D shows the ridge characteristics relied on in the identification. The Chemical Examiner certified that the

brown marks on the calendar were mammalian blood, the inference being that the murderer or his associate gripped the calendar with his blood-stained thumb when rummaging amongst the papers in the despatch-box for the key of the safe. The accused was committed for trial before a judge and accessors, charged with murder and theft, and was finally convicted only of having stolen the missing property, the assessors holding that as no one had seen the deed committed, it would be unsafe to convict him of the murder, and the Supreme Court upheld this decision.

(*c*) The Deptford case.—In 1905 a man and his wife were murdered in their bed at a house in Deptford, London. They were in the habit of placing their money each night in a small cash-box kept under a pillow of the bed. After the murders the cash-box was found in the bedroom broken open, and the money gone. On the side of its inner tray was a faint digital mark, which was immediately photographed.

Subsequently two brothers, named Stratton, were arrested on suspicion, it being known to the police that they were in the locality about the time the murders were committed. Their finger-prints were taken, and the right thumb-print of one of the brothers was found to be identical with the mark on the cash-box.

No one saw either of these men go into the house or leave it. The finger-print evidence was most valuable.

They were convicted of the murders, and executed.—*Times*, May 8, 1905.

Forgery *of thumb-print signatures.*—It is not difficult to forge thumb-prints, as Major H. Smith, I.M.S., has shown, by covering the original thumb-impression with a damped paper and pressing, by which method the reverse of the original is transferred to the damped paper, and another piece of damped paper is then put over the reverse and pressed, when a true copy of the original adheres to the paper.

Foot-prints of Babies.—To prevent the crime of changeling or deliberate substitution of babies, or the accidental changing of babies by confusion in maternity hospitals, the system is now introduced of taking as a precautionary measure an impress of the babe's footprint, which thus forms a permanent life-record of identity.

The printing is taken in the same way as the finger-print. But it may be done so simply that any lay-parent can do it for themself. All that is necessary is to cover the sole of a child's foot with printer's ink by means of a roller, and then transfer the impression to a sheet of paper. The ink can be cleaned off the foot with alcohol. Care must be taken not to disturb the impressions before they are dry. There will then exist for all time a record of the baby's identity which would carry weight in any court of law in after years. No matter how much the feet grow, the lines will have grown with them, and their pattern will not be changed.

Bertillon's measurements of the ear and certain bony points which do not vary between adolescence and old age are specially used for the detection of criminals, but being more difficult to make, and varying so much with the personal equation of different operators, the use of this system has been given up by the police in India in favour of the finger-print

system. The ear measurements are obviously useless in so many tribes which distort their ears by plugs and heavy rings, and in the thickening of leprosy.

Acquired Peculiarities.

1. **General condition** of body.—Fat and muscular or the reverse, baldness, etc.

2. **Scars and traces of old injuries.**—Scars by wounds, burns, and ulcers (syphilitic and other) tend to contract and become more linear in time, but being less vascular than the rest of skin, they are rendered more visible by friction. If necessary a lens should be used. Their number, situation, size, whether adherent, depressed, etc., should be noted—the size should be measured with compasses. A scar is inevitable after a wound, but where there is little loss of tissue and no suppuration, the scar may be slight. Small linear scars may disappear in time. Casper notes that the linear scars of cupping disappeared in three years. Large scars never disappear, and those of burns, scalds, and crushed wounds are more permanent than those of incised wounds. No scar can be artificially removed. It is very difficult to swear to the age of a scar, some remain red and vascular after many years.

Old fractures and ununited fractures may enable the identity to be established. The body of Livingstone, the great African explorer, was identified by an ununited fracture of the humerus due to the bite of a lion. In case of *Hanbil* v. *Nazeer Khan*,[1] identity was established by a peculiarity in the jaw-bone.

Case.—A Bengali impostor pretended he was a native gentleman whose death and consignment to the Ganges some years before was plainly proved. He denied the former fact and alleged that after being thrown into the river he revived. Medical evidence exposed the imposition by proving that part of the body of the deceased had been eaten away by an incurable disease.[2]

3. **Tattoo-marks.**—Unlike scars which are the result of accident or disease and located variously, tattoo-marks are the result of deliberate choice and often by the same operator, so that the same design may be reproduced exactly in the same situation on more than one individual. The pigment generally used in India is black or blue, but in Burma red is also extensively used. Pigments consisting of vermilion and ultramarine disappear more readily than Indian ink, soot, gunpowder, or carbon in other forms, which latter, according to

[1] 3 *Niz. Ad. Rept.*, 122 Chevers, 48.

[2] Chevers, 100.

Tidy, never disappear if inserted properly below the epidermis. The shortest time in which non-carbonaceous marks disappear is agreed to be ten years. Tattoo-marks cannot be removed unless the skin is destroyed, in which case a scar would remain. The claimant in the Tichborne case (p. 54) had a scar where it was sworn Arthur Orton had been tattooed. Faded tattoo-marks are made more distinct by strong friction.

4. **Loss of teeth and artificial teeth.**—Loss or deformity of teeth and presence of false teeth or correspondence of the jaw with a mould taken by a dentist for the purpose of fitting artificial teeth may be important in establishing identity (see Parkman's case, p. 69). The body of the Raja of Benares, who was slain in battle by Kuttub in 589 of the Hijra, was recognized among heaps of the slain by its artificial teeth, which were fixed in by golden wires and wedges.[1] A bite may show certain teeth missing; and so identify the biter.

5. **Occupation marks.**—Hands horny or otherwise; stains in hands of dyers, photographers, and painters, needle-pricked fingers in tailors, etc.; this is chiefly useful in unknown dead bodies.

6. **Memory of past events.**—This is often of great importance in cases of imposture, see Tichborne case, p. 54.

7. **Handwriting,** speech and voice, gait, tricks of manner, etc.

8. **Clothes and jewelry,** viz., ring, watch, visiting card, letter, etc. These are only of very secondary importance, as they are easily changed; for characteristic differences of native dress, see p. 50.

Light sufficient for Identification.

A flash of lightning undoubtedly affords sufficient light to enable an individual to so distinctly discern the features, etc., of another, as to be able to subsequently recognize him. The flash caused by the discharge of a pistol or gun, provided the circumstances are favourable, also similarly affords sufficient light for recognition and identification. Favouring circumstances are: close proximity to the discharge on one side of the line of fire; absence of other light; and not much smoke from the powder

[1] Dow's *Hindustan*, I., 145.

Identification of Fragmentary Remains or Bones only.

The first thing to determine is whether the fragmentary remains are human or not. Then you note which side of the body or limb they belong to and try to fit the fragments together; noting the means by which the fragments have been separated, whether cut, or broken or torn asunder or merely grazed by dogs, jackals or other beasts or birds of prey. The state of decomposition of the soft parts may give a clue to the length of time elapsed since death. If vital organs are present, note whether they bear marks of injury likely to have caused death.

Where *bones only* are available it is desirable to record the details of the several bones individually (see Fig. 1, p. 40), for reference and proof of age, stature, etc. Any malformations should be specially noted. The odour of recent bones should be noted for the time of death. The odour of bones cleaned by ants, etc., is very different from that of old bones cleaned by decomposition in the earth.

"Professor A. Powell has upset a romantic police theory of murder by finding the nutrient canals of a skeleton filled with red wax containing much arsenic. He concluded the bones had come from a dissecting room."

In another case the skin from the lower part of the abdomen showed a linear operation scar with only two transverse stitch marks—one at either end. This suggested the operation had been performed by an American surgeon who used a continuous suture so that all the loops, except the first and last, remained buried below the surface. This fact led to the identification of the body.

Cases.—(*a*) **Callus and fractured bones**—Detachment of sacrum.—At Bankura in 1833 two witnesses deposed that the deceased, Meah Khan, was beaten a few hours before his death, one of the blows breaking his rib. The only bone produced in court was a rib, this had been broken but had osseous callus around both fractured ends, from which the civil surgeon was of opinion that the fracture must have occurred at least seven or eight days before death. The body in question was disinterred three months after the death of Meah Khan and the bones were found clean and free from periosteum, ligament, and cartilage, which the civil surgeon considered rendered it extremely improbable that the bones were those of a person who had died three months previously. Dr. Chevers, however, considered that mere *cleanness* of the bones could be accomplished by natural decomposition if exposed to the ravages of multitudes of ants and insects, the odour, however, of a recent bone thus rapidly cleaned by insects would in no way resemble that of one which had gradually undergone denudation underground.[1]

[1] Chevers, *M.*, 66.

(*b*) **Dr. Parkman's case.**—Dr. Parkman, of Boston, U.S., was last seen alive entering the medical institution in which Dr. Webster was a lecturer on chemistry. A week afterwards, suspicion having been excited, search was made in Dr. Webster's laboratory, and the remains of a human body discovered. In one place a pelvis, right thigh, and left leg, were found; and in another the entire trunk and the left thigh. Among the ashes in the furnace of the laboratory, fragments of bone, blocks of mineral teeth, and a quantity of gold, were also found. Some of the chief points in the case were: (1) No duplicate parts were found. (2) The pelvis was clearly that of a male. (3) The parts of the body were free from all traces of the preservative fluids always employed in the dissecting room of the college. (4) *Piecing the parts together it was estimated* that the height of the body of which they formed portions was 70½ inches, or exactly the missing Dr. Parkman's height. (5) Three of the fragments of bone found in the ashes of the furnace when put together, made up the greater portion of the right half of a lower jaw. This was of peculiar shape, certain teeth were wanting from it, and it was found to fit exactly a cast of Dr. Parkman's jaw, which had a short time before been taken by a dentist who had supplied Dr. Parkman with artificial teeth, similar to those found in the furnace ashes. Dr. Webster was convicted, and subsequently confessed that he had murdered Dr. Parkman.—Guy, *F. M.*, 32.

(*c*) **Careless identification of bones.**—A married woman and her child, a girl aged four or five, disappeared at Meerut, under circumstances pointing to their having been murdered by a man named Kulloo, the woman's paramour. Kulloo absconded, but was subsequently apprehended while trying to sell ornaments proved to have belonged to the missing woman. Kulloo, when apprehended, made contradictory statements accusing other parties of the murder, and ultimately led the police to a place where several human bones were found, among them portions of two skulls, one small, the other larger. Among the fragments of the larger skull was an entire upper jaw (and half a lower jaw) with the teeth attached, and, near the bones, clothes, identified as having been worn by the child, were found. The civil assistant-surgeon, to whom the bones were sent, reported the bones to be those of two children, one about eight years, the other about eight months old. On this Kulloo was convicted of theft only. A re-inquiry was ordered; and at the trial held fourteen months afterwards, the civil surgeon was of opinion that the assistant surgeon had mistaken the bones of a small adult female for those of a boy, of about eight years old. The judge convicted the prisoner of murder, sentencing him to transportation for life. Here, had the portions of the larger skull been examined, and a record kept of their appearance, and of the teeth in the portions of the jaws, the question whether they belonged to a child of eight or to an adult could probably have been determined without difficulty.—Chevers, *M.*, 66.

(*d*) **Teeth and cartilage-tumour.**—(i) Identity of body was established by absence of left lateral incisor and by hair on back of head. Prisoner convicted. (ii) Remains of cartilaginous tumour of the neck in a body almost skeletonized led to identification.—*Ind. Med. Gaz.*, January, 1875.

The **Stature** may be approximately fixed by laying out the skeletal bones and allowing 1½ inches for the soft parts. If the femur is not found, the width of the two arms abducted from

the trunk gives the 'fathom,' which nearly coincides with the height.

For estimating the stature from one cylindrical bone, Orfila gives a table which may err to the extent of over 4 inches. Tidy gives the following data in percentages of height.

Humerus from 17·4 to 19·5; radius, 13·2 to 14·5; femur, 22·6 to 27·51; tibia, 18·5 to 22·15; spine, 36·8 to 31·54.

To the above is added 1 to 1½ inches for the soft parts of sole of foot and the scalp: the variation, however, is too great to be of much service. In a dry skull with a hole in it of an alleged fracture, note if the hole is due merely to the falling in of an os triquetrum (when its margins will be jagged) or to a true fracture.

Even when identification is not established the death-sentence may yet be passed.

Cases.—(*a*) **Death-sentence with non-identified remains.**—*Reg.* v. *Sundamen.*—Deceased was induced by two others to leave his village under the pretext of looking for stolen cattle. On the way he was murdered. On the fourth day remains were found—"his skull in three or four places, grey hairs, a pair of shoes, and a bag with flint and steel. The jackals, vultures, etc., had nearly picked the bones clean." There was circumstantial evidence, and the sentence was—death to first prisoner. —*Madras Reports of Foujdaree Udalut*, 1859.

(*b*) **Non-identified remains.**—*Reg.* v. *Mahābalaya.*—Deceased was a Brahman, who had been sent to cash a cheque on a Friday, and did not return, and on the following Wednesday the remains of a man, with a Brahmanical thread, were found. "The witnesses could not identify the body, as the features were entirely decomposed." Some clothes near the body were identified, and certain persons who had been last seen with deceased were, on the strength of circumstantial evidence, convicted. The sessions judge recommended transportation for life, because the body had not been clearly identified, but the High Court (Foujdaree Udalut), seeing no reason to doubt that the remains were those of the missing man, sentenced to death.—*Madras Reports of Foujdaree Udalut*, 1859. Honore, June, 1859.

CHAPTER II.

EXAMINATION OF THE LIVING PERSON.

This is usually much simpler than the examination of the dead in criminal cases, as it is often little more than a mere matter of surgical diagnosis. The medical expert should be furnished by the police or others with a note for his guidance, identifying the person and detailing every known circumstance of importance in the case on which his examination and opinion are required. This should be sent along with the person who is to be examined. In practice, the information thus sent to India is generally meagre and omits points of critical importance, and often it is untrustworthy and occasionally false.

The Record of the medical expert should note:—(1) The exact *time* and *place* of your examination; (2) the *name, sex*, age, occupation, and caste, if any, of the person examined; (3) the *personal-identity*, how made: this, in the case of a living person, is usually made by the police official who brings the person for examination or by some other mutually known individuals—whose names should be noted by you in your record and report: in the case of unknown persons, the necessary particulars for identification should be noted from amongst those detailed on page 35, etc.; (4) *details of the examination* of the alleged Wounds, or evidences of Rape (Chap. XIV.), Abortion (Chap. XV.), Insanity (Chap. XVIII.), Poisoning (Chap. XXI.), etc., as described in the special chapters.

Examination.—In the case of persons accused of criminal violence, you will look for scratches and other evidences of a struggle, such as the presence of hairs, blood-stains, etc., on the body and clothing. But before making an examination of an accused person you must *first obtain his consent*, and inform him that any indication which may be found of an incriminating nature will be used as evidence against him, and if he will not consent, the examination must not be made. Neither must

you ask 'leading' questions or those which suggest the particular answer.

Your examination in some cases, such as rape, may extend to besides (1) the person of the victim, and (2) the accused, also to (3) site of the alleged offence, and to (4) stained clothes, weapons, or other articles submitted to you for examination.

The Exhibits, as these latter objects are termed, should, after examination, be carefully preserved by you as evidence, and should, whilst in your custody, be carefully sealed up by yourself and locked away to prevent their being tampered with. If sent to the Chemical Examiner, they should be duly labelled, attested, and sealed with your personal seal, of which an impression may accompany your letter to that officer (see detailed 'Directions' in Appendix IV.). Where there is more than one exhibit, each should be marked by a distinctive letter or number.

As the **alleged cause** of injury is not always the *true* cause, it is necessary for you to consider other possible causes than that which may be specified in the indictment.

Case.—**Alleged beating with poisoning.**—Stupor ascribed to a beating *found really due* to Datura poisoning.—A gentleman beat his punkah coolie with a slipper for going to sleep; some hours after the man was taken seriously ill. He became giddy and partially comatose. In this condition he was immediately taken before the doctor. He was made to vomit, and brought up a quantity of Datura seeds, which he had taken in a fit of passion after a love quarrel. Now, if this circumstance had occurred away from the station, and the man had died, the body would have been sent in with the remark "said to have died from the effects of beating." The medical examination would have established death from the effects of Datura, or in *default of a thorough examination* "no apparent traces of injury."—Chevers, *Manual Med. Jur.*, 35.

Your examination in cases of '*grievous hurt*,' *alleged rape*, *criminal abortion*, or *insanity*, should include the points noted in Appendix I. G—J, as well as those under those respective articles.

The Report Certificate of the results of your examination should invariably be prepared from your recorded notes with the utmost care and scrupulous precision, never perfunctorily. *Write legibly* and use in mentioning a disease the 'Nomenclature of Diseases.' *Never sign a certificate blank*, leaving the details to be filled in by an assistant. Where formal certificates are called for, read carefully the printed instructions and *refresh your memory each time* you write a certificate. For death-certificate, see p. 98.

CHAPTER III.

EXAMINATION OF THE DEAD BODY.

THE medico-legal examination of a dead body for an inquest or other inquiry is one of the most important duties of civil surgeons and police-surgeons, and for its proper performance the most expert and experienced pathologist available should be employed. In Law, no assault can be committed against a dead body, so that in performing a *post-mortem* examination you are not committing an "offence." Yet it is an operation only to be conducted under due official warranty.

Legal Necessity for the Examination.

The object of the examination is to ascertain the cause and manner of death in all deaths from violence, or in sudden deaths from unknown causes, and in those suspicious cases in which the medical attendant is unable or refuses to give a death-certificate (see p. 98). In such cases it is not otherwise possible to exclude death from criminal violence even when unsuspected in death occurring apparently from 'natural causes.' For it is not uncommon to find that cases of apparently natural death without any external mark or wound on *post-mortem* examination prove to be cases of fatal poisoning, or fracture of the skull or ribs, rupture of internal organs, etc. See cases under-noted.

Cases.—(*a*) An old man was found dead in bed one morning, having apparently died in sleep. Face placid, pale. P.-M. examination showed death from carbolic acid poisoning. There was no smell of the acid in the room, and no bottle was found near the body, though afterwards one was found containing the acid in the house. No odour was noticed until the stomach was opened. There was no corrosion of lips, and nothing externally to indicate the nature of the case.—Sir H. H. Littlejohn, *Trans. Med. Leg. Soc.*, I., 1902, p. 16.

(*b*) A man travelling by train to Edinburgh, was found some stations off, apparently asleep under influence of alcohol, and died before reaching the hospital. There was no odour or bottle to be found, and nothing to suggest death from other than a natural cause. The magistrate demanded only a certificate based on external examination, but owing to

the man's life being insured, a P.-M. examination was made, and revealed poisoning by prussic acid, probably suicidal.—Sir H. H. Littlejohn, *Trans. Med. Leg. Soc.*, I., 1902, p. 16.

(*c*) An old man was thought, after inspection of the body, to have died from heart failure of old age, but was subsequently found to have shot himself in the mouth with a revolver. There was no external evidence of the cause of death; no alteration of features, no effusion of blood, and no weapon found until some days after the event.—Sir H. H. Littlejohn, *Trans. Med. Leg. Soc.*, I., 1902, p. 17.

The body of a murdered person must as a rule be produced, be identified, and be examined, in order to warrant a conviction in law and even a trial. The many facilities for destroying dead bodies in India (see p. 20), affords the criminal in this country unusual opportunities for destroying this important part of the evidence of his guilt.[1]

On the other hand, the sentence of death was confirmed in a case in 1901, where the body was never found—

Case.—**Death Sentence** when body not found.—The appeal of Sheomangar Singh, the Raipuri Zemindar, who was convicted of the murder of a woman and sentenced to death by Mr. Stuart, Acting Session Judge of Allahabad, came before Mr. Justice Blair and Mr. Justice Chamier in the Allahabad High Court recently. In this case the body of the woman was never found, having been thrown into the Ganges, and Mr. Stuart referred to the question of passing sentence of death when the body of the murdered person had not been recovered. Their Lordships, in the course of their judgment, said: "No case could have been more satisfactorily proved, and it is difficult to imagine a case of grosser brutality. The conviction is thoroughly justified and the sentence is the only sentence possible." Their Lordships confirmed the sentence of death.—*Pioneer Mail*, July 12, 1901.

Method of Examination.

First the dead person is to be *identified* and then the *Cause of Death* is to be ascertained. Before beginning the examination it is advisable that the examiner be informed regarding all the circumstances of the death as far as is known; whether any violence was received or any known disease or condition which may have contributed to the death. Otherwise certain questions may be raised at the trial which the examiner may be unable to answer through not having his attention specially

[1] "According to Indian law, as administered by the Nizamat Adawlat, the finding of the body is not indispensably necessary to warrant even a capital sentence; but, in such cases, an irrevocable sentence is not usually passed." (Goodeve, in Beaufort's *Digest*, 1857, Homicide and Murder, Index C. *s.* 3980.) Goodeve here cites the case of Kanlal *v.* Chundwa (2 *Niz. Ad. Repts.* 82); bones were found, but these not being identified the court withheld the capital sentence, notwithstanding a confession, and in one of *Hanbil* v. *Nuzeer Khan* (3 *Niz. Ad. Repts.* 122), the result was the same notwithstanding the recognition of the skull by a peculiarity in the jaw-bone.—Chevers, *M.*, 48.

directed to them. Begin your **notes** by recording the exact date and hour, place, when and where the examination is made, and how the body was identified.

The **Identification** when the body is found not long after death can be easily made by some one who knew the deceased intimately. But if putrefaction has set in, or an accident has disfigured or destroyed the features, or only a skeleton be left, the identification should be made by the medical expert in the manner already described (p. 35), for sex, age, state of teeth and jaws, height, general condition, colour of eyes and hair, whether any part denuded of hair, deformities, tumour, old scars, tattoo, perforations for nose and ear-rings ; and everything distinctive in the way of dress, a ring, watch, letter or card, artificial teeth, sample of hair, etc., should be kept as evidence by the examining officer. When a body is that of some unknown person a photograph should be taken. In a skeleton, the following points should be specially noted, (1) whether the bones are human or animal, (2) sex, (3) height, (4) age, (5) race, (6) deformities or signs of previous injuries, (7) position in which bones are lying, and (8) probable length of time they have been buried or lying.

The **Cause of Death** in suspected criminal cases is sought for by (1) Inspection of the position, attitude and surroundings of the body on the spot where it was found before removal; (2) External examination of the body itself and its clothes and coverings (p. 76) ; (3) Internal *post-mortem* examination (p. 95).

I. Position, Attitude, and Surroundings of Body.

If summoned to the spot where the dead body has been found and is still lying, note carefully before removing the body or displacing its clothes :—

1. **Attitude of body** and position relative to surrounding objects. Note whether the body is lying on the ground or floor, or is lying on a bed, couch, or other article of furniture, or is seated or supported in a semi-erect or erect attitude, and, if so, how supported, or is suspended partly or completely by a ligature round the neck, etc., etc. Note the attitude of the limbs, and the position of the body in regard to surrounding objects; for example, whether the body is lying at the foot of a precipice, tree, or other high object from which it may have fallen, or is immersed wholly or partly in water, or is lying in a room, and if so, in what part of the room, etc., etc. Photographs for these and other conditions are desirable.

2. **Nature,** condition, and position of objects in contact with or lying near body. Note if any objects are lying loosely in, or are tightly grasped by, the hands (not merely gluing by clotted blood); and if so, their nature and condition. Note any marks of jetting or spotting of blood on the walls, etc.—their presence indicates the person was still alive where found. Note the position, nature, and condition of any ligature on the body, and the exact situation of the knot, whether or not any stains of blood, vomit, etc., are present on or near the body, on floor, walls, doors, windows, or furniture, or any finger or footmarks, and whether any weapon or any vessel likely to have contained poison is lying near it, preserving such weapon, vessel, etc., for further examination. Note whether any confusion in the furniture or other signs exist in the neighbourhood of the body indicative of a struggle having taken place, or of the employment of weapons, or generally of the presence of persons other than the deceased, at the spot about the time of infliction of the injury.

Although examination of the spot where a dead body has been found and of the position of the body in regard to surrounding objects, often affords valuable information as to the circumstances under which death occurred (see cases of 'Wounds'), it must be recollected, however, that the spot where the body has been found may not be the place at which the act was done which caused death. In such a case the question will arise: What power of locomotion remained to the deceased after the act was done which caused his death, and was this sufficient to enable him to move from this spot at which the act was done, to that where the body was found? [1] The answer to this question may, it is evident, have an important bearing on the question: Was death due to homicide, suicide, or accident?

II. External Examination of the Dead Body.

Before detailing the **method** of this examination (p. 92), it is desirable here to consider the Modes and Signs of death, as two questions often asked are 'Is life extinct?' and 'How long has the person been dead?'

Death Modes.—By 'death' of the body is popularly meant '*somatic*' (as opposed to '*molecular*' [2]) death, *i.e.* the total

[1] See 'Wounds,' Chap. VI.

[2] '*Molecular*' death of the individual tissues and cells of the body does not occur till some time after somatic death.

extinction of the vital activity of the entire body which is kept going by the heart and lungs acting under the control of the brain. Hence it is usual, following Bichat's arbitrary classification, to speak of **three Modes of Death,** according to whether death begins in one or other of these three organs respectively, irrespective of whatever the remote cause of the death may be:—(1) syncope (death in heart); (2) asphyxia (in lungs); (3) coma (in brain).

A more practical view and more in keeping with the facts is that formulated by Professor Powell for the assistance of medical practitioners in doubt whether to certify the cause of death as coma, syncope, or shock. He writes: "Even in cases of gross lesions of heart or brain, death in 'inhibition,' 'shock,' or 'syncope' arises from a paralysis, a failure of the heart muscle to contract. Immediately after death owing to failure to act—to contract—the heart is in diastole. Nature abhors a vacuum, therefore both sides of the heart are usually full shortly after death from inhibition.

"Later, when *rigor mortis* sets in, the heart, like the other muscles, becomes rigid, contracts and expels the blood from its cavities. If the autopsy take place now, Bichat's empty heart is found. Later, when rigor passes off, and gaseous decomposition has set in, the pressure of the gas drives the blood from the veins into the right side of the heart and distends it.

"Hence in death from syncope the *post-mortem* signs vary according to the time at which the autopsy is made.

"1*st Stage.*—Heart in diastole, flabby, both sides distended.

"2*nd Stage.*—In *rigor mortis,* both sides contracted and empty.

"3*rd Stage.*—In decomposition the right side, except in cases of hæmorrhage or perforation of the abdomen or thorax, will be full.

"After death from asphyxia, the pulmonary vessels being full, the contraction of *rigor mortis* is insufficient to empty the right ventricle."

Post-mortem signs of these modes of death are:—

In syncope if death has occurred by anæmia, both sides of the heart are found empty, and the heart itself, if examined soon after death, is contracted. If death occurred by asthenia, or by poisoning with prussic acid, the heart is found relaxed, flabby, with its cavities empty or full—if the latter, both sides are equally full. In coma and asphyxia the venous system and right side of heart and lungs are gorged with dark blood, and the left side of heart is usually empty. In coma there is effusion of blood into the serous cavities, apoplexy, rupture of vessels in fracture of skull, etc. In asphyxia there is much greater engorgement of lungs and venous system than in coma, and the lungs may show apoplectic effusions into

their substance with patches of superficial emphysema and sub-pleural ecchymosis or Tardieu's spots (see 'Asphyxia'). In some cases of sudden death the most careful examination fails to find any of these positive lesions. In such cases it may be that death occurred by the sudden stoppage of the heart by violent emotion.

Signs of Death.

"Lend me a looking-glass;
If that her breath will moist or stain the stone,
Why, then, she lives!"
Shakespeare's *King Lear*, V. 3.

The fact of actual death is ordinarily ascertained with little difficulty. The most patent and positive sign of death is the commencement of general putrefaction of the body, which takes place some time after death. But a considerable time before putrefaction has set in, the fact of death is occasionally the subject of some doubt. Cases have occurred in which persons in a state of deep trance or catalepsy have been supposed to be dead and been *buried alive* (see below). It is well, therefore, never to give a death certificate, or think of opening the body until you make quite certain that the body is actually dead as detailed in 'Signs of Death' (p. 81), and 'Apparent Death and Death-trance' (see below).

Simulated death for purposes of extortion is easily detected by pricking with a pin or by the application of a flame or the actual cautery to the skin, or insertion of cayenne into the conjunctiva.

Apparent Death, Death-trance, and Premature Cremation or Burial.

The tragic possibility of cremating or burying live persons is in India a very real danger, in view of the hurried disposal of bodies within a few hours after apparent death, owing to climatic reasons, and the want of sufficient medical examination. Even in Europe, where a long interval of several days intervenes, numerous authentic cases are recorded of people being buried alive or rescued by accident on the verge of the grave. In India many cases also are reported,[1] and there is reason to believe that this practice is not altogether infrequent. Such individuals rescued from the funeral pyre usually lose their caste, and pyre attendants have admitted that when bodies show signs of animation they stuff mud into the mouth and nostrils of the body in the belief that the movements are the work of evil

[1] *Indian Jour. Med. and Phys. Science*, 1836, I., 389; *Calcutta Jour. Med.*, 1869, II., 383; W. Tebb, *Premature Burial*, London, 1896, pp. 60–63, 90, 91, 125, etc.

spirits. Suspended animation may possibly occur not merely in the rare instance of lethargic stupor and catalepsy, but in the commoner acute diseases, cholera, fever, sunstroke, and other nervous affections, traumatic concussion, tetanus, 'teething' convulsions, lightning-stroke, drowning, chloroform-poisoning, collapse after child-birth, in still-born infants. In such cases, where there is the slightest doubt of actual death, artificial respiration and other restoratives should be assiduously practised; *even when the circulation and respiration have apparently ceased.* In the case of infants these attempts to restore the possibly latent life should be persisted in for several hours (see cases below), and in no case should one single 'sign' of death short of putrefaction be relied on. The salutary British military rule which compels a *post-mortem* examination on every soldier, *not earlier than twelve hours* after disease, is a safeguard that should be made of universal application in India. In 'death-trance' where no sign of vitality can be recognized, the presence of life may be ascertained, (1) by the absence of any sign of decomposition, (2) by the normal appearance of the fundus of the eye as seen by the ophthalmoscope, (3) by the persistence of the excitability of the muscles to electricity—this excitability disappears in about three hours after actual death.

Case.—**Premature Burial.**—The celebrated actress, Mlle. Rachel, 'died' at Paris on 4th January, 1858. After the process of embalming her body had already been begun, she awoke from her trance but died ten hours later from the injuries thus inflicted.—Dr. Hartmann, *Premature Burial*, London, 1896, p. 80.

Case.—**Yogi's Ecstatic Trance.**—In Delhi in 1889, Dr. H. C. Sen and his brother, Mr. Chandra Sen, Municipal Secretary, examined a well-known *Yogi* devotee in a self-induced trance in which he appears to have been seated cross-legged in Buddha-fashion. They found that the pulse had ceased to beat altogether, nor could the slightest heart-beat be detected by the stethoscope. The *Yogi* was placed in a small subterraneous masonry cell and the door locked and sealed by the city magistrate. At the expiration of thirty-three days the cell was opened and the devotee found just where he was placed but with a death-like appearance, the limbs having become stiff as in *rigor mortis.* He was brought from the vault and the mouth rubbed with honey and milk and the body massaged with oil. In the evening manifestations of life returned. He was fed with a spoonful of milk, and in three days was able to eat his normal diet, and was alive seven years after.—W. Tebb, *Premature Burial*, 1896, pp. 44, 45.

Case.—**Children resuscitated four to seven hours after apparent death.**—Prof. Fort reported a child aged three as resuscitated by artificial respiration continued for four hours and *not commenced until* $3\frac{1}{2}$ *hours* after its apparent death.—Tidy, *Leg. Med.*, I., 39. Ogston records the case of a child being alive about seven hours and a young woman alive four hours after they had been left as dead.

The **exact moment of death** (*i.e.* somatic death) is sometimes of importance not only in cases of suspected foul play (see *Onset of Cadaveric Changes*, p. 85), but in successorship, where it is necessary to prove that a child was or was not born before the death of a testator, as a will takes effect from the moment of the death of the testator, and not from the date of finding or proving the will.

Legal presumption of death.—In India the law is (*a*) that if a person is proved to have been alive within thirty years, the legal presumption is that he is still alive, except (*b*) it is proved that the person has not been heard of for seven years by those who would naturally have heard of him if he had been alive, in which case the law presumes that he is dead (*ss.* 107 and 108, I. Ev. Act). The law, however, presumes nothing as to the time of his death, the period of which, if material (as it often must be in cases of succession and inheritance), must be proved by evidence. In either case the presumption arising may be rebutted by proof, in case (*a*) of the person's death; in case (*b*) of his being still alive. In France, a legal presumption of death arises after thirty-five years of absence, or after one hundred years from date of birth.

Question of presumption of Survivorship.—When two or more persons die at almost the same time, or by a common accident, the question may arise who survived longest; and if no direct evidence on this point is available the question becomes one of presumption of survivorship. As an example of the cases in which this question arises, suppose A to have left property by will to B, and that A and B die by a common accident, no direct evidence being available as to whether A or B died first. Here the question of presumption of survivorship may arise, because if A died before B, B may be considered to have succeeded to the property left him by A, and B's heirs inherit; while if B died first, A's heirs inherit, seeing that B never succeeded to the property willed to him by A. In some countries definite rules of law exist by which such cases are decided. In France, for example, some of the rules laid down are (1) If all those who perished together were under fifteen, the oldest shall be presumed to be the survivor. (2) If all were over sixty, the youngest shall be presumed the survivor. (3) If all were between fifteen and sixty, the males shall be presumed to have been the survivors if the ages were equal, or the difference in ages not greater than one year; in other cases the youngest shall be presumed the survivor. The English law presumes nothing in cases of this kind, and if therefore a person made a claim and had, in order to substantiate it, to prove that A survived B, and had no proof of that fact beyond the assumptions arising from age or sex, he could not succeed. It may, however, be pointed out, that in questions of this kind it is likely that the strongest lived longest. There are, however, certain exceptions, *e.g.* (1) When a mother and child both die during delivery, if the death of the mother has been caused by hæmorrhage, it is probable that the mother died first. (2) If a number of persons die from the effect of excessive heat, it is probable that the adults died first, children and old persons bearing heat better than adults. (3) When the cause of death is drowning, as females are more likely to faint than males, and as the occurrence of syncope delays death by asphyxia, it is possible that females may survive longer than males. If, however, there has been a struggle for life, it is probable that the males,

being stronger, survived the females. (4) Where the cause of death is starvation, aged persons (if healthy and robust), requiring less food than adults and children, probably live longest.

The chief **Signs of Death** are :—

1. **Cessation of Circulation or Heart-Beat, complete and continuous.**—The entire cessation of the circulation for over five minutes is usually in itself evidence of death. In cases of fainting and prolonged typhoid of low type, and 'suspended animation' the heart may cease to beat for several seconds, and in newly born infants and in the apparently drowned may cease for ten or fifteen minutes, but continuous and complete cessation means death. M. Rayer, from observations on the dying, assigned seven seconds as the maximum interval observed between the last two pulsations of the heart. Tidy (*Leg. Med.*, I. p. 138) quotes a case of a man aged 33, where for eight minutes no heart sounds could be detected, the man ultimately recovering.

Suspended Animation under Anaesthetic.

Case.—**Child resuscitated after Heart had stopped for thirteen minutes.**—A. Davies, aged six, Streatham, was having his tonsils removed for adenoids at Guy's Hospital in 1916, when the heart failed. An incision over the cardiac region was made and the heart massaged, until its action was restored. Recovery was complete and the boy now runs about as usual. "It is certain that the heart had stopped at least thirteen minutes."—*Guy's Hospital Magazine*, 1916.

Suspended animation—Voluntary.—Cases are recorded of persons who have apparently possessed the power of voluntarily suspending the action of the heart.

Cases.—(*a*) **Case of Colonel Townshend**, quoted from Cheyne (Guy, *For. Med.*, p. 214) :—"He (Colonel Townshend) told us that he had sent for us to give him some account of an odd sensation he had for some time observed and felt in himself, which was that, composing himself, he could die or expire when he pleased, and yet by an effort or somehow he could come to life again, which it seems he had sometimes tried before he had sent for us. We all three felt his pulse first; it was distinct though small and thready, and his heart had its usual beating. He composed himself on his back, and lay in a still posture some time; while I held his right hand, Dr. Baynard laid his hand on his heart, and Mr. Skrine held a clean looking-glass to his mouth. I found his pulse sink gradually, till at last I could not feel any by the most exact and nice touch. Dr. Baynard could not feel the least motion in his heart, nor Mr. Skrine discern the least soil of breath on the bright mirror he held to his mouth. Then each of us by turns examined his arm, heart, and breath, but could not by the nicest scrutiny discover the least symptom

of life in him. This continued about half an hour. As we were going away (thinking him dead), we observed some motion about the body, and upon examination found his pulse and the motion of his heart gradually returning; he began to breathe gently and speak softly." Col. Townshend died the same evening, and on *post-mortem* examination all the viscera were found healthy except the kidneys, for disease of which he had been long under treatment.

(*b*) Dr. Duncan, Edinburgh, mentions the case of "a medical student who, like Col. Townshend, simulated successfully the appearance of death; he died, however, some time afterwards of disease of the heart."—Ogston, *Med. Jur. Lect.*, 364.

Tests to ascertain whether the circulation has ceased:—(*a*) **Pulse.**—Feeble pulsations of the heart may not be perceptible at the wrist, besides the radial arteries are sometimes abnormal in their distribution. (*b*) **Auscultation.**—Stethoscope may fail to detect a very feeble pulsation of the heart. (*c*) **Tie cord tightly round a finger.**—If any circulation is going on, the finger will swell beyond the ligature. (*d*) **Open small artery,** if still in doubt. No jerking spurt will occur if the heart is not beating. (*e*) **Heat or a blister on skin** will not produce a true vesicle **with red** margins on a dead body. (See 'Burns.')

2. **Cessation of respiration,** complete and continuous.—Three and a half minutes is considered the extreme limit during which respiration may absolutely cease and life be maintained. In divers and in Cheyne-Stokes respiration, two and one minutes respectively are the probable limits. In newly born children life has been known to continue for a considerable period without respiratory movements being apparent, and occasionally in older individuals.

Tests:—(*a*) A cool bright looking-glass held in front of the mouth will be dimmed by the moisture of the breath if respiration is going on. (*b*) A feather held over nostrils will move if respiration is continuing. (*c*) A shallow vessel of water or mercury placed on the chest will show movement in its reflection of a spot of light from its surface if there be movement of the chest walls.

Case.—**Suspended respiration.**—Professor Maschka, of Prague, related in his lectures that a "mature child, which showed no signs of life, was placed in the anatomical rooms of the university, left there for fourteen hours, and then taken to the physiology classroom. On laying open the chest, no blood flowed from the integuments and soft parts in front. When the heart was reached, it was seen pulsating at the rate of twenty beats per minute. The lungs were seen to be in the fœtal condition."—Ogston, *Med. Jur.*, 365.

3. **Changes in the eye,** *e.g.* loss of sensibility of the pupil, loss of transparency of the cornea, loss of tension of the eyeball. None of these are reliable. The pupil may for a short time after death still respond to the action of atropia; and loss of transparency of the cornea, and of tension of the eyeball, may occur during life.

4. **Cooling of the body.**—After death the temperature of the body tends to fall to that of the surrounding objects, and if these, as is usually the case, are lower in temperature than the body, a gradual cooling of the body takes place.

In death from certain diseases, however, the temperature of the body may, at the time of death, be higher than the normal, and may even rise considerably after death. Thus in cases of death from yellow fever, cholera, small-pox, rheumatic fever, Bright's disease, abscess of the liver, peritonitis, tetanus, and injuries of the nervous system generally, etc., a *post-mortem* rise of temperature, amounting in some cases to even 9° F., has been observed,[1] owing to chemical changes in the molecular life of the tissues, and partly in some cases due doubtless to microbic activity. The normal body temperature in India ranges from 97° F. to 99° F.,[2] whilst the mean temperature of the air and surrounding objects in India is frequently 90° to 97° F., or even more in the summer and autumn. Hence a body may rapidly 'cool' as far as is possible under these circumstances, and so permit of *rigor mortis* setting in at a very much earlier period than in temperate Europe. The average rate of cooling in a temperate climate is about 4° F. during the first three hours, and afterwards about 1° F. per hour. In temperate Europe a dead body is cold in from eight to ten hours. In tropical or sub-tropical India much less time is required, as the body has to cool through far fewer degrees of temperature to reach the temperature of the air and its surroundings. Loss of heat is **delayed** by (1) Acute fever as the cause of death. (2) Sudden death, as the nutrient material continues to burn after death. (3) High temperature of surrounding air or water. (4) Stillness of air in small room. (5) Obesity and bulk. Bodies of children and the aged cool more quickly than middle aged. (6) Covering of body by non-conducting clothes, etc., retards loss of heat. It is **hastened** by (1) Chronic wasting disease. (2) Lingering death. (3) Coldness of air. (4) Access of cool draughts of air. (5) Leanness and extreme youth or old age. (6) Exposure of body without coverings. (7) Immersion in water, especially running water.

5. **Cadaveric hypostasis,** or 'Suggilation.'—This *post-mortem* staining of the skin is due to the fluid blood sinking under the effect of gravity to the most dependent parts of the body. It begins to appear a few hours after death (3 to 4 Tidy, 4 to 12 Mann), first at back of neck, chest, and calves as a dusky red discoloration. Hypostatic congestion indistinguishable from *post-mortem* suggilation may set in *long before death:* Professor Powell has seen striking hypostasis in morphine poisoning, in plague, and in cholera two hours before death.

It can be distinguished from the true ecchymosis of a bruise by observing that (1) it is only in the most dependent part of the body, (2) it is not elevated above general level, (3) its margins are sharply defined, (4) its surface is not abraded, (5) an incision into it does not show clotted blood outside the vessels but simple staining. This distinction can be made even when decomposition is far advanced.

[1] Tidy, *Leg. Med.*, I. 46. [2] Waddell, L. A., *Ind. Med. Gaz.*, 1884.

Cases.—(*a*) **Hypostasis** mistaken for marks of injury. *Emp.* v. *Falkytter*, Cachar Sessions, 1898. Lt.-Col. Borah, I.M.S., deposed that "the back of the head, the back of the neck, the back of the buttocks, the back of the thighs and of the calves were covered with bruises" such as might have been caused by blows of a stick. On cross-examination he admitted he was unable to distinguish *post-mortem* hypostasis from contusions. Accused was acquitted.

(*b*) Three men left a public-house intoxicated and quarrelling. On the next morning one of them was found expiring in a wood, and he died soon afterwards. Two surgeons deposed that they found the marks of numerous contusions all over the body, and upon this deposition the two companions of the deceased were committed and subsequently tried. At the trial, Drs. Bell and Fyfe proved, to the satisfaction of the court, that the apparent contusions were nothing else than the livid patches, or hypostasis, which sometimes occur spontaneously on the dead body after many kinds of death. The accused were acquitted.—Taylor, I. p. 88.

See *Bain* Case in Appendix.

6. **Cadaveric rigidity, or Rigor Mortis.**—This stiffening, which occurs after the body has become 'cold,' is due to changes in the muscles on their molecular death. After somatic death, the muscles pass through three stages, namely, 1st, relaxed with contractility; 2nd, rigid and non-contractile —the *rigor mortis* stage; and 3rd, relaxed with incipient decomposition.

In the 1st stage the muscles are relaxed, but contract on the application of stimuli. This stage in exceptional cases may last only a few minutes, or even be absent, as in the case of soldiers killed in battle clutching their guns or swords, and pistols or knives grasped in the hands of suicides—this form has been called cadaveric spasm (see p. 87). This relaxation lasts about three hours. There is no case on record where this stage has lasted as long as twenty-four hours. In Bengal, Mackenzie found the average to be 1 hour 51 minutes. If therefore the muscles respond to electric stimulation over three hours after supposed death, there is a presumption against actual death (see 'Death-trance').

In the 2nd stage, that of cadaveric rigidity, or *rigor mortis* proper, the muscles become rigid, partly from coagulation of myosin. All muscles, both involuntary and voluntary, are affected, and the rigidity occurs independently of nerve influence (paralyzed limbs becoming rigid unless complete degeneration of the muscles has taken place), and independently also of the rate of cooling of the body. It is *hastened* by any exhausting influence on the muscles immediately before death (see *Bain* Case, App. V.), such as violent muscular exercise or exhausting disease. It is *retarded* in speedy death of healthy individuals in repose.

The time of onset of cadaveric changes in India is different from in Europe.—As the time of onset of the cadaveric changes is of great importance in fixing the time of death, and there were no data on record for India, Dr. Mackenzie undertook

in 1883, a series of observations to ascertain these points, the results of which are here summarized.

Summary of Onset of Cadaveric Changes in India.[1]

Changes.	Average.		Earliest.		Latest.		Average for October of 10 cases.	
Muscular irritability lasts from	hrs.	min.	hrs.	min.	hrs.	min.	hrs.	min.
death	1	51	0	30	4	30	1	42
Rigor mortis begins	1	56	0	30	7	0	1	10
,, ,, duration	19	12	3	0	40	0	31	30
Green discoloration appears ..	26	4	7	10	41	0	24	16
Ova of flies appear	25	57	3	20	41	30	—	
Moving maggots appear ..	39	43	24	18	76	0	81	21
Vesications appear	49	34	35	0	72	0	59	8
Evolution of gases	18	17	5	50	34	30	29	17

The changes were observed in the bodies of persons dying in hospital in Calcutta mostly from chronic diseases.[2] Thirty-six cases were examined between July and September with an average aerial temperature of 85·5° F., and 10 cases in October with an average air temperature of 81·8° F. It will be seen that, as was to be expected, the data differ considerably from those made by Casper in Berlin and by other observers in Europe—the changes generally occurring considerably earlier in India owing to the heat and humidity.

Time of onset of Cadaveric Changes in India.

This is very variable. Sometimes it commences within a few minutes after death, under the conditions above noted, but usually in temperate climates it begins 5 to 10 hours after, and takes about 2 to 3 hours to develop.[3] In India, owing to the climate and to the body becoming 'cold' more quickly, it usually commences 1 to 2 hours after death, and takes 1 to 2 hours to develop.

[1] *Based on Dr. Mackenzie's data for July to September*, 1889.

[2] *Ind. Med. Gaz.*, 1889, p. 167.

[3] Niderkorn found it to be fully developed before the end of the seventh hour after death in 92 out of 113 cases (Tidy, *Leg. Med.*, I. p. 62). Taylor (3rd Ed., 1888, I. 513) gives 5 to 6 hours from death for *rigor mortis* to set in, 16 to 24 for its continuance, or 21 to 30 hours from death on an average. Tidy gives 3 to 6 hours, and from 36 to 48 hours respectively, or 27 to 54 hours from death on an average. But in sudden death in a muscular subject for hæmorrhage, *rigor mortis* may continue for 14 *days* or longer (Tidy, *Leg. Med.*, I. 71). The figures apply to a cold climate.

Onset of Rigor Mortis.—Of the 36 cases observed by Mackenzie in Calcutta, in July to September, the earliest onset of *rigor mortis* was 30 minutes, the latest 7 hours, and the average 1 hour and 56 mins. In 6 cases it was from 30 minutes to 1 hour, in 19 cases from 1 to 2 hours, in 5 cases from 2 to 3 hours, in 2 cases from 3 to 4 hours, in 3 cases from 5 to 7 hours.

In cases where just previous to death the muscles have undergone great fatigue, and also in cases where the irritability of the muscles has been exhausted by a powerful electric discharge, as in death from lightning stroke, also in death from cholera, tetanus, poisoning by opium or strychnia, rigidity may come on at once and the body stiffen in the position it was in at the time of death. On the other hand, in cases of sudden death, except from lightning, rigidity comes on late, provided always, of course, that the muscles just previous to death have not been subject to great fatigue, or to anything tending to exhaust their irritability.

Duration.—This depends greatly on the state of the muscles at the time of death. Generally speaking the sooner rigidity sets in the *sooner* it passes off, and the longer it is in appearing the *longer* will it last. It averages 24 to 48 hours in temperate climates (Tidy), but may continue for several days. Cold tends to prolong and heat (probably) to shorten it. For India, Dr. Mackenzie [1] observed the following times. Of 36 cases the shortest duration was 3 hours, the longest 40 hours, while the average was 19 hours and 12 minutes. In 3 cases it lasted less than 5 hours, in 6 cases from 5 to 10 hours, in 3 cases from 10 to 15 hours, in 6 cases from 15 to 20 hours, in 14 cases from 20 to 30 hours, and in 4 cases from 30 to 40 hours.

Order of onset and disappearance.—In Europe this rigidity appears: 1st, in muscles of lower jaw; 2nd, in face, neck and trunk, and lastly, in limbs, and it disappears in the same order. In Bengal in the rains it appeared in the majority of cases: 1st, in lower jaw and neck simultaneously; 2nd, in back muscles; 3rd, upper limbs; 4th, lower limbs, and it disappeared in same order.

Case.—**Time of death determined by rigor mortis.**—Case of Jessie McPherson (Glasgow, 1862). *Reg.* v. *McLachlan.*—The body was first seen by Dr. Macleod on the night of the 17th July, *i.e.* in midsummer, when the mean temperature of the air was 50° F. "The *rigor mortis* was present in all the articulations, but it was then departing. The body was perfectly cold, even on the abdomen and at the flexures of the joints. There were no signs of decomposition, and the temperature was usually cold. By 10 A.M. on the next day, *rigor mortis* had disappeared from all the joints except the knees and the ankles. Death had resulted from violence and from profuse hæmorrhage. The

[1] Brinton, *Amer. Jour. of Med. Soc.*, January, 1870.

victim was free from disease. *Rigor mortis* sets in generally from 10 hours to 3 days after death. When, however, death has been sudden, and is due to violence, it sets in more slowly; and Macleod therefore considered that in this case, at least, 48 hours must have elapsed from the time of death until the rigidity set in. But when the *rigor mortis* sets in slowly, it lasts all the longer and *vice versâ*, the average period of disappearance being from 24 to 36 hours. He therefore considered that in this case the rigidity must have lasted 30 hours, and, putting these figures together (48 and 30), he arrived at the conclusion that about 3 days had elapsed since death. The evidence subsequently recorded proved, as nearly as could be, that this was the time which had passed between death and the examination of the body."—Taylor, 3rd Ed., I. p. 85.

See also Gardner's case, and Sudhabode Bhattacharji's case.

Cadaveric spasm, or instantaneous *rigor mortis*, is a term applied by Taylor and others to rigidity which *in rare cases* occurs at the moment of death in sudden deaths. This rigidity passes sooner or later into *rigor mortis* though not unnecessarily identical with it. It is usually muscular contraction. Very rarely important evidence as to the cause of death may be derived from the presence of objects in the hands under the influence of cadaveric spasm; but *the object is not usually grasped*, as the fingers usually relax after death.

Case.—**Alleged fabrication of evidence of suicide.**—"A man tried in France, in 1835, narrowly escaped conviction as the murderer of his father. The latter had been found dead in a sitting posture, with a recently discharged pistol in his right hand, the weapon resting upon the thigh in such a way that the slightest motion of the part would apparently have caused it to fall. It was assumed that the son had produced the injury to the face, which had been the cause of death, and had afterwards placed the pistol in his father's hand, in order to induce the supposition of suicide. The medical evidence, by showing that the grasping of the weapon could not have been simulated after death, lead to an acquittal." [1]—Ogston, *M. J. Lect.*, 365.

See also case of *Imp.* v. *Sudhabode Bhattacharji.*

With the disappearance of rigidity, the 3rd stage of relaxation, due to incipient decomposition, commences; this softening is not necessarily putrefactive, as micro-organisms are not always found in the relaxed muscles in this stage.

7. **Putrefaction,** General.—This condition, which begins when *rigor mortis* ceases, is the most absolute and certain of all signs of death. It is the decomposition of the nitrogenous elements of the tissues by bacteria (chiefly *bacterium termo*) with colour changes and the evolution of foul-smelling gases.

Ante-mortem Gases.	Post-mortem Gases.		
	Early.	Later.	Latest.
H	H_2	CH_4	NH_3
CH_4	CH_4	CO_2	CO_2
CO_2	CO_2		
SH_2	SH_2		
O	PH_3		
N			

[1] Ogston, *Brit. For. Med. Rev.*, 1857, 303; Tidy, *Leg. Med.*, I. 64.

The putrefaction changes occur generally in this order.

(*a*) **Colour changes.**—Externally a greenish spot appears on the abdomen with odour of putrefaction and the eyeballs become soft and yielding. Greenish discoloration spreads over body. It is due to destructive decomposition of the red blood corpuscles with the solution of their hæmoglobin in the serum. In Calcutta during the rains, Mackenzie found that the latest period at which the green discoloration of putrefaction appeared was 41 hours and 30 minutes, the earliest period was 7 hours and 10 minutes, and the average period was 26 hours and 4 minutes. In 2 cases it occurred under 10 hours, in 4 cases from 10 to 20 hours, in 18 cases from 20 to 30 hours, in 10 cases upwards of 30 hours, and in two cases it was not observed at all.

(*b*) **Blisters form under the epidermis.**—Mackenzie's latest period for the appearance of vesications on the surface of the body was 72 hours, the earliest period was 35 hours, and the average period was 49 hours and 39 minutes. In 17 cases it occurred in from 35 hours to 48 hours, in 10 cases from 48 to 60 hours, in 5 cases from 60 to 72 hours, and in 4 cases it was not observed at all.

(*c*) **Maggots appear.**—The time of appearance of these is much earlier in India than in Europe. The latest period at which *immature* maggots (which are chiefly the larvæ of the house-fly and flies of the "blue-bottle," *Calliphora sp.*) appear was in Mackenzie's cases 41 hours and 30 minutes, the earliest period was 3 hours and 20 minutes, and the average period was 25 hours and 57 minutes.

The latest period of the appearance of the *mature* or moving maggots was in Mackenzie's cases 76 hours, the earliest period was 24 hours and 18 minutes, and the average period was 39 hours and 43 minutes. In 6 cases it occurred in from 24 hours and 18 minutes to 30 hours, in 16 cases from 30 to 48 hours, in 11 cases from 48 to 72 hours, in 1 case upwards of 72 hours, and in two cases it was not observed.

(*d*) **Post-mortem emphysema.**—Gases distend cavities and tissues till the walls burst open and discharge their contents, and the brain runs out. These gases, developed under considerable pressure, cause various characteristic swellings and displacements of organs and their contents. Thus this gas (1) *Puffs up features*, rendering recognition increasingly difficult. (2) "Causes the eyeballs and tongue to protrude." (3) "Puffs up the tissues of the neck which become greatly swollen, accentuating the natural groove which becomes pale and exsanguine from the mutual pressure of the swollen folds, frequently giving rise to an erroneous diagnosis of strangulation. (4) Distends the abdomen, causing the body if submerged in water to float, causing the anus to gape, the fæces to be expelled, the rectum and other viscera to prolapse, eventually bursting open the body cavities. (5) Forces the contents of the stomach and lungs to escape from the mouth, often in the form of frothy and bloodstained mucus. (6) The pressure, before the abdominal wall gives way, drives the blood from the abdominal vessels into the vena cava, thence into the right side of the heart and into the lungs. Hence, other things being equal, the weight of the lungs gradually increases after death. In a large series of autopsies Powell has found the average weight of the Indian lungs to be, Left, 12½ oz.; Right, 14 oz., when the autopsy has been performed within four hours of death. Left, 17½ oz.; Right, 19 oz., when the autopsy has been performed over 18 hours after death. (7) If there be a wound on the body, whether *ante-mortem* or *post-mortem* from the nibbling of rats, insects or crustaceans, the gaseous pressure will cause

post-mortem bleeding from the veins. This explains the origin of the ancient ordeal in which the corpse was supposed to miraculously bleed in the presence of its murderer. (8) In the case of females there may be *post-mortem* delivery of the fœtus up to the sixth month, and in cases where the os has already dilated and the female has died in labour, even a full-term child may be delivered by the gaseous pressure. The uterus in the latter case is usually turned completely inside out. In the earlier stages of pregnancy the complete uterus containing the fœtus may prolapse.

From the above description it will be seen that gaseous decomposition gives rise to conditions in the eyes, tongue, neck and anus, popularly associated with strangulation. The greatest caution must therefore be exercised in giving an opinion that death was due to strangulation if the body is first seen after gaseous decomposition has set in.

It is to be feared that many a miscarriage of justice has taken place from ignorance of the natural processes of decomposition in hot climates.

(*e*) **The softened flesh falls from the bones.**—The brain, liver, spleen, stomach, and intestines putrefy most rapidly, the heart, lungs, kidneys, bladder, and blood vessels more slowly, the last organ in women to putrefy is the uterus.

Onset and rapidity of putrefaction.—This is so rapid in the hot plains of India that it visibly begins in about 25 hours; but no definite estimate can be given of its rate of progress. In Europe in summer it occurs within 1 to 3 days after death.[1] It is hastened or delayed respectively by the following conditions, affecting the growth of bacteria or animal organisms.

(*a*) **Temperature.**—The temperature most favourable to putrefaction seems to be between 70° and 100° F., hence bodies putrefy more rapidly in summer than in winter. Low temperatures below 32° F. arrest putrefaction altogether, hence well-preserved bodies of mammoths are found buried in arctic ice after thousands of years. Temperatures over 100° F. tend to delay it, and a temperature of 212° F. arrests it entirely.

(*b*) **Access of air.**—Free access of ordinary air promotes putrefaction owing to entry of bacteria of decomposition, hence tight-fitting clothes, or a tight coffin retard putrefaction, whilst a bruised or mangled body putrefies more rapidly. Bodies putrefy more rapidly in air than in water, and less rapidly in earth than in water.

(*c*) **Moisture.**—Moisture promotes, and absence of moisture retards, putrefaction. Hence, putrefaction is more rapid in moist than in dry air and is much retarded by submersion in water, when the chemical change into adipocere may occur, see below. Bodies, however, after removal from water very rapidly decompose. 'Mummification,' see p. 91, may occur in hot dry air.

(*d*) **Condition of the body,** age and cause of death.—Putrefaction is more rapid in bodies of persons dying suddenly and in fat, flabby or dropsical bodies and in newly born children and in women dying in childbirth than in cases of death from exhausting diseases and in emaciated bodies, doubtless owing to excess of fluid in the former cases. Parts injured at the time of death usually putrefy more rapidly. The presence

[1] Casper, I. 33, 37, 40, 52.

in the body of certain poisons, *e.g.* arsenic, antimony, chloride of zinc, and phosphorus, tends to delay putrefaction. Powell's experience is that in alcoholic poisoning decomposition is rapid.

(*e*) **Antiseptics and poisons.**—These, of course, retard putrefaction—arsenic, antimony and alcohol amongst poisons. Lime, contrary to the popular belief, retards putrefaction.

Adipocere.

Sometimes instead of the decomposition of putrefaction, the corpse may undergo the *post-mortem* change of (1) Saponification, forming *Adipocere*, or (2) Mummification.

This saponification change only occurs in the case of bodies wholly submerged in water or cesspools, or buried in deep moist graves. The substance then formed is chemically a soap of ammonia and lime, and is called 'adipocere' on account of its fat (*adeps*) and waxy (*cera*) appearance. It is probably produced by the fatty acids of the fat combining with the ammonia of the decomposed nitrogenous tissues of the body, and latterly as time goes on part of the ammonia is replaced by lime. Physically, it is a soft, waxy-looking substance, greasy to the touch, and varying in colour from a dull white to dark brown and of a disagreeable rancid odour. On fracture it exhibits traces of fibres and the blood vessels between which the soap is deposited. Its specific gravity is less than water, it melts at about 200° F., is soluble in ether and alcohol, and on heating with caustic potash it yields ammonia. It is a very permanent body and may last twenty years and upwards. The subcutaneous fat and bone-marrow first undergo this change; the normal internal organs are not often so altered.

Time required for the change.—Observers in Europe were of opinion that a low temperature by retarding decomposition favoured this change. Taylor and Casper show that adipocere has been found in bodies immersed in water from five weeks to one year, but rarely in less than three to four months, and all the soft parts had not completely undergone this change after a year's immersion. The process occurs more slowly in damp soil than in water, though in the case of a fœtus buried in a damp cellar it occurred in three weeks (Casper). The bodies of children and obese persons are more rapidly converted on account of the excess of fat, and in the former case the fat contains three times more fatty acid with less oleic acid (Langer).

In India, however, Dr. Coull Mackenzie, police-surgeon of Calcutta, has recorded eight cases (*I. M. G.*, 1889, 42) in which this change seems to have occurred *within three to fifteen days*

after death, thus apparently disproving the theory that a low temperature conduced to this change. These cases occurred in the submerged bodies of persons drowned in the Hughli river at Calcutta, or buried in the hot damp soil of Lower Bengal.

Cases.—(*a*) A male Hindu was killed in July by the kick of a horse, and was buried the following day. Four days after burial, the body was exhumed in order that an inquest might be held. It was found in an advanced state of saponification externally, the heart and liver being also saponified. The body was buried in soft porous soil, saturated with moisture, the temperature being high, in the rainy season. (*b*) An adult Chinese woman alleged to have died in child-birth was buried in September under circumstances which necessitated an inquest. The body was exhumed seventy-six hours after interment, when it was found to be considerably saponified. Her body was buried in similar soil and temperature, and in a wooden coffin. (*c*) A young European was drowned in the river Hughli in September, his body being recovered seven days after. It was in an advanced state of saponification externally, the lungs, heart, liver, kidneys, stomach, and intestines were also saponified, and what is very curious is that the stomach contained undigested food (flesh and potatoes) of which the flesh was entirely saponified, the potatoes not being altered in the least. (*d*) A European sailor was drowned in the Hughli in October, and his body recovered eight days and ten hours after immersion, was found to have the external parts as well as the heart, liver, spleen, kidneys, stomach, intestines, and bladder saponified.

Similar experiences have been subsequently recorded[1] from Bengal, in which the body of a young Bengali woman buried in September three feet deep in alluvial soil on the bank of a pond, when exhumed three weeks afterwards was found to have undergone "apparent saponification." And in another case, the body of a boy, nine years of age, buried in a shallow grave, covered with nine inches of water, was found to have undergone this change four days after death.

For a recent thoroughly ascertained case of rapid adipocere reported by Professor Powell of Bombay and supported by chemical analysis, see Appendix VI.

Mummification, or desiccation or shrivelling up of the body, by its losing rapidly its fluids.—This occurs only in hot dry climates with hot air in motion, such as in sandy deserts, *e.g.* Sindh, Beluchistan, etc., and parts of Upper India where the bodies are perched in trees or between the rafters of a roof.

Practical Examination of the Dead Body.

The clothes of the body should be examined before removed for the detection of signs of a struggle, marks of blood, etc., to enable comparisons to be made with injuries on the body. If the clothes are removed before being seen by the examiner, *post-mortem* rigidity will be destroyed in parts, abrasions or bruises

[1] Dr. Moir, *Ind. Med. Gaz.*, 1897, p. 197, and Dr. V. Ashe, *id.*

may be found, and even the contents of the disturbed stomach may be forced into the mouth or larynx so as to give suspicion of accidental choking. First, the general condition of these should be noted, *e.g.* whether showing marks of fire, or corrosion; or wet, or stained with blood, dirt, secretions, or excretions. The clothes, etc., should then be more particularly examined; note should be taken of any cuts or tears upon them, and of the correspondence or otherwise, of these with wounds on the body. Any peculiarities of the clothes, or of the ornaments found on the body, likely to aid in establishing its identity, should also be recorded.

External Examination of the Body itself.

For this the clothes should be taken off, and any marks resembling bruises washed to make certain that it is not dirt or external stains. In India, dead bodies are often submitted for examination in an advanced state of decomposition. Such bodies should nevertheless be examined externally, and as far as possible internally also; the fullest possible examination of the body should invariably be made, not necessarily for report to magistrate, but for inclusion in your own notes for reference, and to establish your own opinion. The plan of making a partial examination is only admissible when the body is extremely putrid and decomposed; but even in such cases, although the medical officer is at liberty to decline to make an internal examination of highly putrid corpses, some distinct evidence as to how death was caused may often be obtained, as for example, when this has been the result of wounds, fractures, or other violence, or of the administration of certain poisons; besides the condition of the uterus might give vital information, and the presence of solid fæces in the gut would negative alleged death from cholera.

External examination of the body should include a search for—

1. **Signs indicating the Time elapsed since death.**—That is, whether the body is warm or cold, its condition as regards rigidity, and the extent to which putrefaction has advanced. It is possible that an estimate formed as to the period which has elapsed since death may bear greatly on the question of (*a*) the identity of the body, and (*b*) the guilt or innocence of accused persons (see case below).

The question of how long a body has been dead is sometimes of the utmost importance in cases of murder where accused pleads an *alibi*.

The advanced state of putrefaction of a body may show, for example, that death must have occurred at a period considerably anterior to the date of disappearance of the individual whose body it is alleged to be; or as in the following case of Gardner the condition of the body of a murdered individual may show that death must have taken place at a time when the accused had access to the victim, and not subsequently to the time of termination of such access.

Case.—**Time of murder** indicated by condition of body.—Gardner, the sweep.—Gardner lived with his wife and another woman, their servant. The wife was found dead in her bedroom, with wounds on her throat, at 8 a.m. Her extremities (which were uncovered) were cold, and rigidity was well marked. The circumstances of the case conclusively indicated murder, and Gardner was suspected and brought to trial. Gardner was proved to have left the house on the morning of the murder at 4 a.m. and was absent until after 8 a.m. The defence alleged that the woman was murdered during Gardner's absence. The medical witnesses in the case gave it as their opinion that, from the condition of the body when first seen at 8 a.m., it was clear that the woman had been dead more than four hours. Hence she must have died before Gardner left the house. This and the other evidence in the case led to the conviction of the prisoner.—Taylor, *Med. Jur.*, I. 83.

See also case of Sudhabode Bhattacharji.

Any estimate, however, based on *post-mortem* examination must necessarily be only approximate. You should consider especially the following points :—

(*a*) **Temperature of the body.**—In the tropics where the temperature of surrounding objects is but little above that of the body the latter 'cools' in a few hours. Observations in temperate climates show that the dead body cools down to a temperature a little above that of the external air in fifteen to twenty hours, the fall of temperature being more rapid in the earlier than in the later hours after death.

(*b*) **Conditions of the muscles.**—If these are relaxed and contractile it is probable that not more than $1\frac{1}{2}$ to $1\frac{3}{4}$ hours in the plains or 3 to 6 hours in the hills have elapsed since death. If rigid, probably more than 3 and less than 36 hours have elapsed in hills; for plains see table, p. 85.

(*c*) **Amount of putrefaction.**—Other things being equal, the greater the amount of this the longer the period which has elapsed since death. The rapidity of putrefaction, however, varies so greatly with the circumstances already detailed that no general rule can be laid down for estimating by its amount the length of time which has elapsed since death occurred.

2. **Marks of violence,** or other external marks indicative of the cause of death.—Note if there are any **stains of blood,** or other matters, on the surface of the body. In the case of blood stains, it is specially important to note their situation and form, as this may show that they have been produced by some individual other than deceased, *e.g.* the impress of a right hand

on the right hand or forearm of the body or abrasion from violence (finger or other pressure, falls, etc.). Examine for marks of powder-grains or burns of powder in gun-shot wounds; marks about mouth (poison or suffocation); marks of a hypodermic syringe; burns, however trivial. Specially search for bloody thumb- or finger-prints (see p. 56). Note whether or not *cutis anserina*[1] is present, and whether any matters are sticking under the nails. Note whether the features are pale and natural, or livid and swollen, the condition of the eyes, and position of the tongue, and whether or not this shows marks of injury from the teeth. Examine the orifices of the body for presence of foreign bodies, marks of concealed punctures, and marks of corrosion, and note the nature of any fluid oozing from them. Examine, at first without dissection, the whole body for wounds or contusions, not omitting to examine by palpation the bones for fractures and to search for marks of concealed punctures under the breasts, scrotum, and eyelids, and in the armpits and nape of the neck, and, in the cases of infants, in the fontanelles, and along the whole course of the spine.

Then, employing such dissection as may be requisite, note in regard to all **wounds, fractures or other marks of injury**: (1) Exact situation.—This should be recorded with reference to some fixed point on the body, *e.g.* distance of a wound in inches from the top of the pubis or sternum, angle of the jaw, etc.; position, with reference to hyoid bone or laryngeal cartilages of a ligature mark on the neck, etc. (2) Exact dimensions, *e.g.* measured in inches, the length, breadth, and depth of wounds, breadth of ligature marks, etc. (3) Direction, *e.g.* in a punctured wound, whether it is directed from above down or below up, and whether from right to left or left to right; and in incised or other linear wounds or marks of injury, whether or not one end is higher than the other, and, if so, whether the upper end is anterior or posterior to, or to the right or left of, the lower. In the case of certain fractures, *e.g.* of the ribs, note whether the broken ends of the bone have been driven inwards or outwards, by the violence used to cause the fracture. (4) Appearance, and how far this indicates (*a*) the method, and (*b*) the time, of their production. Under (*a*) note, in the case of wounds, whether the edges are contused or lacerated, or apparently clean cut, and in the latter case examine them with the aid of a lens for signs of tearing, or appearance of inversion, indicative of production by a blunt weapon. Note the general shape of any wound, contusion, or burn; this may indicate the shape of the weapon or heated object which has been used.

[1] Goose-skin, see 'Drowning.'

In the case of an *incised* wound, compare the appearance of the two ends of the wound, with the view of ascertaining the direction in which the cutting instrument was drawn in producing it. In gunshot wounds, if two orifices exist, compare their appearance, noting any characters indicating one or other to be the orifice of entry or of exit. Note also whether or no any blackening or marks of gunpowder exist round the wound. Examine any wound for the presence of foreign bodies, preserving such as may be found. Under (*b*) note, in the case of wounds, whether or no the edges are retracted or averted, and whether or no blood or blood clots are present in the wound, or signs of inflammation exist around it. In the case of apparent contusions, note if the skin over them is abraded; examine the edge of the contused surface for changes of colour, and, *by* dissection, ascertain if the underlying tissues contain extravasated blood so as to distinguish ecchymosis from cadaveric lividity. In the case of ligature marks also, the condition of the tissues underlying the mark should be ascertained. If the injury is a burn note the presence or absence of vesication about it, or of a line of redness, or signs of inflammation around it.

Bear in mind, while conducting the examination, the characters which distinguish *ante-mortem* from *post-mortem* wounds and burns (*q.v.*). Recollect, also, that under certain circumstances putrefactive changes may simulate signs of strangulation. There may, for example, be protrusion of the tongue, due to such changes; and putrefactive swelling against a string loosely tied round the neck, may result in the production of a depressed mark, somewhat similar to that left by the ligature in death from strangulation.

In infants the external examination should, in addition, include examination for (1) degree of maturity, namely, length and weight, condition of the eyes, condition of the skin, nails, and scalp hair, and position of the middle point of the body and (2) live birth, or the reverse, *e.g.* exfoliation of the scarf skin, condition of the umbilical cord, presence of signs of intra-uterine maceration (see 'Infanticide').

III. Internal Dissection of the Body.

After the external examination has been fully made, the internal examination by dissection should be performed as thoroughly and as soon as possible.

Preliminaries.—The warrant or authorization to perform a dissection should always be taken to the examination, and on

one should be present at the examination out of mere curiosity unless authorized, and it is desirable that the examination should be made in daylight without artificial light, though in hot climates one cannot wait for daylight. Complete notes should be made during the dissection, and all measurements accurately determined. Injured parts, diseased organs or portions of them, if necessary, and all foreign bodies should be removed and preserved for further examination. All necessary instruments, bottles, rubber gloves, antiseptics, etc., should be provided before commencing the dissection.[1]

Examination should be complete.—Even if the condition of the parts first examined appears sufficiently to account for death, the remainder of the body should nevertheless be examined, so that you may be in a position to say, not only what was, but also, as far as possible, what was *not*, the cause of death.

Cases are on record, in which a complete *post-mortem* examination of a body has disclosed indications of a cause of death other than that indicated by the conditions of the parts first examined. The appearances first noted may, for example, indicate that death was due to mechanical violence, or to drowning, and yet, on further examination, indications may be found of death from poison (*q.v.*). Or again, the appearances first noted may indicate death from hanging, and yet further examination may show that death was due to strangulation (*q.v.*), or to mechanical violence (*q.v.*), and that the appearance indicative of death from hanging have been fabricated in order to make the case seem one of suicide. Again, if the *post-mortem* appearances show clearly that death was due to a particular lesion, your examination is not complete unless you have noted all particulars which may assist in arriving at an opinion as to whether the fatal lesion was the result of disease or of violence, and if the latter, whether the violence was accidental, suicidal, or homicidal. It has happened that in cases where the medical reports have shown that death was caused (1) by injury to the head, and (2) in case of a woman by strangulation, it was subsequently found that in the first case the ribs were crushed, and in the second, rape had been committed.

Order of making the examination.—If on the surface of the body marks of violence exist of such a nature as to indicate injury to the organs contained in any particular cavity, that cavity **should be first dissected,** and the exact effect of the violence ascertained. Incisions made through the skin for this purpose should avoid wounds likely to have penetrated

[1] In plague autopsies the operator risks fatal inoculation.

the cavities underlying them, so that there may be no interference with the subsequent tracing of the exact course of the wound. In other cases, where a particular cause of death is *suspected*, that cavity should be first dissected in which appearances indicative of the cause of death are most likely to be found, *e.g.* in cases where it is suspected that death has been due to asphyxia, the thorax, and in cases of **poisoning** the abdomen, should be the cavity first dissected.

In cases where the cause of death is **doubtful,** the three chief cavities of the body should be dissected in the following order: (1) head, (2) thorax, and (3) abdomen; the **spinal cord** should be examined in suspected poisoning by strychnia, or some other of the alkaloids, in tetanus, and where there have been symptoms of spinal irritation or inflammation.

In all cases, before opening and dissecting the thorax, the cavity of the abdomen is to be opened, and (without further dissection) the position of the diaphragm, and general appearance of the contents of the abdomen ascertained. Should this preliminary inspection indicate that the cause of death is connected with the abdominal viscera, dissection of the abdomen should be proceeded with; if not, it should be reserved until after the thorax has been dissected.

The **details and method** of making the Necropsy are given in Appendix III. Remember that the more important viscera for examination after the brain are those of the thorax (the heart and lungs), then those of the abdomen, preserving in cases of **suspected poisoning** the contents of the stomach and intestines, and also large portions of the liver, spleen, and kidneys as detailed under 'Poisons.' In infants the examination should be directed not only to ascertaining (1) the cause of death, but also (2) the degree of maturity, and (3) whether or not it survived its birth (see 'Inheritance,' question 6, and 'Infanticide').

Opinion on cause of Death.

No opinion should be given as to the cause of death that is not fully warranted by the appearances observed. If in any case where, on *post-mortem* examination, you may fail to discover appearances sufficient to account for death, a negative opinion only should be given. You are not justified in reporting the death as due to 'natural causes' or 'heart failure'[1]

[1] This phrase is too frequently a cloak for ignorance; there would be no inquest if the heart had not 'failed.' If you find valvular disease or degeneration of the heart muscles, say so. If you can find no evidence of violence or cause of death, say so.

simply because you have failed to find *post-mortem* appearances indicative of death from a non-natural cause. Again, you may find that death was due to a lesion, such as an effusion of blood into the substance of the brain, which may either have been the result of violence or of disease, and the *post-mortem* appearances may do no more than indicate that the fatal lesion was more probably the result of one than of the other. In such a case your opinion should be a guarded one, and be accompanied by the reasons which lead you to consider it to be more probable that death was due to disease or to violence, as the case may be.

The results of the examination should always be duly recorded at the time and on the spot, in a note-book kept for the purpose.

Death Certificates without Post-mortem Examination.

In respect to death certificates the State has entrusted the medical profession with very grave responsibilities, and it behoves every member of the profession to discharge these responsibilities honestly and honourably. The issue of every death-certificate should be regarded by the certifying medical man as a very serious responsibility, and it is especially so whenever there is the slightest suspicion that the death may be unnatural. Those deaths that are obviously "violent and unnatural deaths, or sudden deaths of which the cause is unknown," must immediately be notified to the coroner, or the magistrate who in India performs the duties of coroner, and become the subject of his inquiry or inquest, in the course of which a *post-mortem* examination is usually made before a death-certificate is granted. All other deaths that occur are not so notified, but amongst them is always a considerable proportion with an element of legal doubt, in which a certificate cannot honestly be given without an autopsy. How are these cases to be dealt with?

If the doctor has strong and, as he believes, well-founded suspicion that the death is unnatural, he should report to the coroner or police-surgeon at once without hesitation.[1]

If there is only a slight suspicion (and it is desirable in the public interest that medical men, although not criminal

[1] Cf. F. J. Smith in *Trans. Med. Leg. Soc.*, 1912, pp. 56 *et seq.*, from whose important article much of this is abstracted. Also Dr. W. Westcott, *ibid.*, pp. 64-67, on the Coroner's control of all autopsies. In England "no one but a coroner can legally order a *post-mortem* examination; no magistrate or justice can do it, and a judge could only do so by order of a coroner to hold an inquest."

detectives, should cultivate a certain amount of wholesome suspicion or detective acumen in regard to deaths) he may do one or other of several things. He (1) may get permission for an autopsy and do it, on which he may be able to certify or may have to report to the coroner, (2) he may be refused the autopsy on which he may refuse to certify, or may still certify conditionally, which is a weak move, or (3) he may report his suspicions to the coroner or magistrate without asking for an autopsy.

For example, a frequently recurring difficulty in regard to a death-certificate is when a patient who has been treated for chronic disease (*e.g.* Bright's, heart trouble, bronchitis, phthisis, etc.) dies suddenly a considerable time after the doctor has ceased to visit him, and the former is asked to sign the certificate.

The question arises, at what length of time after his last visit in such a case is a doctor justified in giving a certificate and when is it justifiable? One way out of the difficulty is for the conscientious medical attendant to *refuse a certificate* of the ordinary character, but offer to write a letter to the registrar entering fully into the circumstances of the case, and if he accepts this your responsibility is halved. The 'circumstances' which will vary in detail must contain the following: (1) date and duration of your attendance upon the deceased and your views of his illness at that time; (2) the circumstances under which and the reasons why (*a*) you ceased attending then, and (*b*) you have not recently been in attendance; (3) the circumstances known to you about his home-surroundings—poverty, wealth, attitude of relations, and anything you may have heard from neighbours; (4) any efforts you may have made to obtain an autopsy, and the mode and manner in which these suggestions have been refused; and details you may care to impart to him respecting the close of his life, which from your own professional knowledge and experience may have led you to regard his death as natural or unnatural. Whatever action the registrar may take on this letter, it remains evidence of reasonable care on your part.

The only other solutions are two, namely, (1) swallow all scruples and fill up a certificate, taking care that your dates are scrupulously exact, put in the wholly objectionable words "as I am informed" (but see below) and let the registrar take what steps he likes; and (2) refuse point blank to certify or write, and then all responsibility rests between the registrar and coroner. The circumstances which compel you to one or other of these extreme procedures depend on the individual conscience and the local colouring of the case.

If you decide to give a certificate without a *post mortem* you should observe the following points :—

(1) Re-read carefully immediately before writing the certificate the printed instruction thereof.

(2) Remember if you refuse a certificate without reasonable excuse you are liable to a fine—'reasonable excuse' here can only mean (*a*) Cases of uncertainty as above discussed, (*b*) Illness or accident on your own part sufficiently severe to render you incapable of writing or signing your name; (*c*) Bodily absence on your part necessitated by professional urgency. It *cannot mean* the non-payment of the bill for attendance or any question of personal feeling between yourself and the deceased or the messenger who comes for it.

(3) Never *under any circumstances whatever* give a duplicate certificate, for a medical death-certificate is an original document accepted without question by registrars and undertakers, and a surplus one may and has been used for felonious purposes to perpetrate or hush up a crime.

(4) Only the man who was actually in attendance may sign the certificate; no one is authorized to sign on his behalf.

(5) Never sign a certificate in blank to be filled in by even a qualified person. It is grossly dishonest, illegal, dangerous, and deserves heavy punishment when found out.

(6) Write legibly.

(7) Use the names of diseases in the "Nomenclature of Diseases."

(8) "As I am informed," does not occur in the Act. The use of these words by an *honest* medical man in a death-certificate is inconceivable, as they are in direct antithesis to the very idea of a death-certificate, which means certain fixed positive knowledge, and hearsay is not recognized as such in law.

(9) The distinction between 'primary' and 'secondary' is a mere technical difficulty which can cause little more than temporary embarrassment, when it is remembered that 'primary' here simply refers to time, and the certifier can use his discretion as to how far back he should go.

On the other hand, when there is the slightest suspicion that the death has been unnatural, and this includes not merely deaths by obvious and suspected personal violence, foul play, poison, criminal abortion, etc., but also by operative interference,

anæsthetics, and all sudden deaths of which the cause is unknown, it is clearly the duty of the medical man to report to the coroner or to the magistrate who in India takes his place; or to try all fair means of persuasion to get permission for an autopsy, and failing this to report to the coroner or magistrate. Any private or unauthorized dissection of the body which may have the effect of hiding a criminal offence or culpable negligence renders the operator liable to be made an accessory to the fact should any question of foul play or malpraxis subsequently arise.[1]

Exhumation.

This unpleasant task becomes necessary occasionally where a suspicion of poisoning or other foul play arises some time after the death; or it may be for purposes of identification, as in the case of the body alleged to be that of Livingstone, where identification on disinterment was made by the arm showing a badly united fracture, such as the deceased was known to have had.

Case.—**Druce-Portland Case. Identification after 43 years' burial.**—In this case, in 1907–08, a person named Druce claimed to be a son of the 5th Duke of Portland, who was not known to have been married. It was alleged that that eccentric duke led a double life, in one aspect of which he posed as Thomas Charles Druce, carrying on business as an upholsterer in Baker Street, London. Thomas Charles Druce was twice married, and had a family by each wife; and it was alleged by this grandson who claimed the Portland title and estate that the reputed death and burial of T. C. Druce, in 1864, at the age of 71, was a mock one, and that the coffin contained merely lead. Under the orders of the police magistrate, Mr. Plowden, the vault at Highgate cemetery was opened, and the undisturbed and intact lead coffin was found to contain the body of an old man, who was readily identified as T. C. Druce. The well-preserved state of the body, after so many years' interment, was remarkable. The features were clearly recognized by previous acquaintances, and by comparison with photographs taken during life. "The head was covered with scanty, reddish-brown hair, somewhat whitened, parted neatly on the left side, and brushed slightly over the forehead; the eyebrows thick and wavy, a moustache reddish-brown dropped straight over the upper lip, also whiskers and a beard. The skin was only broken in one part of the body, the lower abdomen, where there were indications of gangrene."

In India, the practice of swift cremation of mortal remains upon the very day of death, which is prevalent amongst the more orthodox Hindus, who form the majority of the population, necessarily restricts the frequency of exhumations in this country, where earth-to-earth burial is mostly limited to Mohammedans, non-Hinduized aborigines, and Europeans.

[1] Dr. Wynn Westcott, *loc. cit.*, p. 66.

In exhuming a body it is desirable that a medical officer be present from the commencement, also any relative or acquaintance of the deceased person who can identify the corpse ; and if buried in a coffin, the carpenter who made the coffin should be present. The examination must be made in daylight, preferably the early morning. Disinfectants or deodorants should be ready, and should be sprinkled around but not upon the body itself. If the coffin is broken, and in cases where there is no coffin, some of the earth above and below the body should be taken and preserved in cases of suspected poisoning for analysis.

The body should be exposed a short time before inspection to allow effluvia to escape, and the observer should stand on the windward side. The stage of putrefaction should be noted.

In recent interments the usual *post-mortem* examination should be made as far as possible. In the external inspection a sample of any characteristic hair on the face should be preserved for identification. After examining the bodily cavities, the stomach and its contents, also contents of bowels, also the liver, spleen, and kidneys should be preserved and sealed in clean bottles for chemical analysis as detailed in appendix. All injured parts should also be removed and preserved when practicable. When a long interval has elapsed since burial, injuries to the bones, especially the skull, and in women to the uterus (which longest resists putrefaction) should be looked for; and where mineral poison is suspected a long bone, *e.g.* the femur, and the earth from the region of the abdominal cavity, should be preserved for analysis.

Limit of time for exhumation.—There is practically no limit of time in English law to the utility of an exhumation. For so long as the bones remain these may afford valuable evidence by which the innocence of suspected persons may be proved, or, on the other hand, the exhumation may prove murder by arsenic or other mineral poison. The Druce case, above noted, shows that the identity in an ordinary vault in a temperate climate may remain clear for upwards of half a century.

CHAPTER IV.

ASSAULTS, WOUNDS, INJURIES, AND DEATHS BY VIOLENCE.

'ASSAULTS' and *wounds or 'hurt'* form the greater portion of the cases coming under the medical officer's notice, and sometimes give rise to questions of much complexity; and medical evidence is especially required in cases where the injuries result in death.

Every attack upon the person of another is an **'assault,'** whether it injures physically or not; and no provocation by word spoken or written can justify an assault, although it may somewhat mitigate the offence. Beating or wounding constitutes **'battery,'** which includes the slightest touch of the finger. Throwing a stone at a person, but missing, constitutes 'assault,' whilst throwing and hitting is assault and battery.

The legal conception of a **'wound'** is much more extensive than the surgical, which latter restricts the term to an injury accompanied by a breach of the skin, and excludes contusions, simple fractures of bones, and ruptures of internal organs. To obviate the use of this ambiguous term, and in view of the necessity for defining whether any particular injury is or is not a 'wound,' is not defined by the Law; but the statute employs the terms **'hurt'** and 'grievous hurt.' Simple 'hurt' is thus defined:—*"Whoever causes bodily pain, disease, or infirmity, to any person is said to cause hurt"* (*I. P. C., s.* 319).

Grievous hurt.—The medical officer is often required to decide whether an injury is 'hurt' or '*grievous* hurt.'

The following kinds of *'hurt'* are designated as *'grievous* hurt' (*I. P. C., s.* 320).

(1) Emasculation; (2) permanent privation of the sight of either eye; (3) permanent privation of the hearing of either ear; (4) Privation of any member or joint; (5) destruction or permanent impairing of the powers of any member or joint; (6) permanent disfiguration of the head or face; (7) fracture or dislocation of bone or tooth; (8) Any hurt which endangers life or which causes the sufferer to be during the space of

twenty days in severe bodily pain or unable to follow his ordinary pursuits.

Sometimes the healing of a simple wound of the scalp, etc., is deliberately delayed or prevented for twenty days so as to bring the severer penalty under this clause; so this possibility should be kept in view.

When an act done by another has caused 'grievous hurt,' or 'hurt,' the doer of the act may be charged with the offence of voluntarily causing 'grievous hurt,' or 'hurt,' as the case may be; or according to the circumstances of the case, with the graver offence of 'attempting to commit **murder**' (*s.* 307), or 'culpable homicide' (*s.* 308), and causing hurt in such attempt.

The kind of weapon used affects the gravity of the offence. Thus, by *ss.* 324 and 326 (*I. P. C.*), the causing of hurt or grievous hurt by certain specified means is made an offence more severely punishable than when such means have not been used. Amongst the means thus specified are "any instrument for shooting, stabbing, or cutting, or any instrument which, used as a weapon of offence, is likely to cause death."

Deadly injury.—If an act done by another results in **death,** the doer of the act may be charged with the offence of committing 'culpable homicide,' or of "causing death by a rash or negligent act."

Culpable homicide (a Scottish term, the English equivalent is **manslaughter**) is defined in *s.* 299 of the *I. P. C.*,[1] and the

[1] Section 299 of the *I. P. C.* is as follows:—"Whoever causes death by doing an act with the intention of causing death, or with the knowledge that he is likely by such act to cause death, commits the offence of culpable homicide.

"Explanation 1. A person who causes bodily injury to another who is labouring under a disorder, disease, or bodily infirmity, and thereby accelerates the death of that other, shall be deemed to have caused his death.

"Explanation 2. Where death is caused by bodily injury, the person who caused such bodily injury shall be deemed to have caused the death, although by resorting to proper remedies and skilful treatment the death might have been prevented.

"Explanation 3. The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child if any part of that child has been brought forth, though the child may not have breathed or been completely born."

With reference to Explanation 2 of the above section, it may be pointed out that it has been decided in England that when a wound has been given "which in the judgment of competent medical advisers is dangerous, and the treatment which they *bonâ fide* adopt is the immediate cause of death, the party who inflicted the wound is criminally responsible" (*R.* v. *Pym*, 1 Cox, C. C. 339; see Mayne's Penal Code 2, *s.* 255). This decision, it will be observed, goes farther than Explanation 2, *s.* 299. Explanation 2 covers all cases where death is due to the effect of neglect or unskilful treatment acting on the injury, but not, like the decision quoted, a case where death is not due to the injury, but to an unnecessary operation undertaken for its cure.

accused may be convicted of this offence even if death followed as **an indirect** result of the injury (see *s.* 299, Explanations 1 and 2).[1] Culpable homicide, according to the circumstances of the case, may or may not amount to murder. Again, when a person has committed suicide, any one who has abetted him in doing so is punishable under *ss.* 305 or 306 of the *Code.* By *s.* 305 abetment of suicide may be punished with death, if the suicide was under eighteen, or was insane, delirious, or intoxicated at the time. Attempts to commit murder, or culpable homicide, are punishable under respectively *ss.* 307 and 308 of the *Code,* and attempts to commit suicide under *s.* 309.

Death or hurt caused by a **Rash or negligent act.**—Where a person has caused the death of another by an act not amounting to culpable homicide, he may be charged with the minor offence of "causing death by a rash or negligent act" (*s.* 304A). Similarly where a person causes hurt or grievous hurt to another, under circumstances which do not amount to '*voluntarily* causing hurt' (*I. P. C.*, 321, 322), he may be charged with the minor offence of 'causing hurt' (*s.* 337), or 'grievous hurt' (*s.* 338), by doing an act "so rashly or negligently as to endanger human life or the personal safety of others." In cases such as these, besides the main question, namely, has the injury caused, or is it likely[2] to cause 'death,' 'grievous hurt,' or 'hurt'? a subsidiary question may also arise, namely, is the character of the injury such as to indicate intention, or absence of intention, to cause a particular result?

Examination of 'Hurt' and Wound cases.

The police bring to the medical officer with the individual to be examined a printed form with the undernoted headings

[1] In India the question, has a certain injury caused death? arises irrespective of the period intervening between the receipt of the injury and death. By the law of England, a person is not deemed to have committed homicide if this period exceeds a year and a day (inclusive of the day of receipt of the injury). This provision does not appear in the Indian Penal Code. Mayne, however (Penal Code, p. 265), thinks that it would possibly be acted on in India as a matter of evidence.

[2] It may be remarked that the opinion of a medical expert may be required on the point whether an injury which has caused death is one which comes under the description of an injury "sufficient in the ordinary course of nature to cause death" (Penal Code, Sec. 300), or one which comes under the description of an injury "likely to cause death" (Sec. 299, *i.e.* whether the injury is one from which death would most probably result, or one from which death would only be a likely result. In the case of *Reg.* v. *Govinda* (1 Bom., 342), Melvill, J., held that under certain circumstances the infliction of an injury which causes death amounts to murder if the injury is one falling within the first of these two descriptions; but only to the minor offence (culpable homicide not amounting to murder) if it falls within the second.

to be filled up, and a note giving what the police state is 'all that is known of the case,' which is usually very meagre.

1. Nature of injury, *i.e.*, whether a cut, or bruise, or a burn, etc. etc.	2. Size of each injury in inches, *i.e.*, length, breadth, and depth.	3. On what part of the body inflicted.	4. Slight, serious, or dangerous.	5. By what kind of weapon inflicted.	Remarks.

The commonest weapon used in inflicting 'hurt' is the *lathi* or staff of solid bamboo, which is used in about 32 per cent. of all assault cases in Bengal, and which being often bound with iron becomes a 'deadly weapon.' For the possibility of serious and even fatal injury without external marks of violence, see p. 113.

Besides filling in this form the medical officer should record in his own notes the detailed results of a thorough examination of the injuries with the view of answering all the various questions that may arise as previously mentioned. For the detailed **Examination of wound cases** see p. 113.

Kinds of Wounds and Hurts and their Weapons.

Wounds are usually described as:—(1) *incised;* (2) *contused* and *lacerated,* including *bruises* (contusions) and *gunshot* wounds; and (3) *punctured.* To these may be added (4) internal injuries without any visible wound or visible breach of continuity of skin.

1. **Incised wounds.**—In examining an apparently incised wound with the object of ascertaining the kind of weapon, if any, used in producing it, it is important to note (1) the situation of the wound, (2) the appearance of its edges, and (3) its length and depth in different parts.

(1) **Situation.**—An apparently incised wound situated on a part where the skin closely overlies a bone, or sharp ridge of bone, may be produced without a weapon or by a blunt weapon. Blows with the fist, for example, over sharp ridges of bone such as the chin, or orbital ridge, or blows with a club on the scalp, may produce wounds closely resembling incised wounds.

Wounds caused in this way are generally, but not invariably, vertical to the bone.

(2) **Edges.**—These should be examined with a lens. Sharp, clean cut, uninverted edges, indicate the use of a sharp-edged weapon; tearing and inversion indicate the employment of a blunt weapon, or production without a weapon.

(3) **Length and depth.**—Long incised wounds indicate the use of a sharp-edged weapon, and may either be caused by a single blow from one with a long, tolerably straight edge, such as a sword, or by a drawing cut from one with a short edge, such as a razor. In the former case, the method of production is often indicated by the underlying bones being clean cut through; and in the latter by the wound tailing off at one end into a superficial scratch (see also (1) kind of weapons, (2) direction of the wound).

The **Weapons** in **Incised** wounds.—The axe or hatchet class usually produce comparatively short incised wounds; either deep, or accompanied by indentation and extensive fractures of the bones beneath. Cutting instruments with a concave edge and projecting point often cause linear wounds resembling a punctured wound at one end gradually decreasing in depth towards the other end. Or if the wound has been inflicted on a curved surface, the puncture caused by the point, and the incised wounds caused by the edge, may be separated by an unwounded portion of the skin.

Weapons of assault, more or less commonly used in India, sharp-edged, and producing incised wounds, are (1) short-edged light weapons, such as the razor (*ustara*) and the knife (*churi*); or (2) heavy short-edged weapons of the hatchet class, such as the axe (*kulhāri*) and the *garasi*, *gandasa*, or *tarash*, an axe-like weapon with a long handle, and sacrificial knife (*khanda*). Weapons allied to this class are the hoe-spade (*phaora* or *kudāli*) and the Gurkha *kukri*, a short, heavy, convex-edged sword. McLeod also mentions as belonging to the spade class the *khurpa*, or grass-cutter's knife. (3) Long-edged weapons, represented by the curved sword (*talwar*), or the straight sword (*kirich*); and curved-edge weapons with a concave edge and projecting point, such as the bill-hook (*dao*, *koita*) and the sickle (*haswa*, *daranti* or *ela*). Wounds caused by broken glass or china resemble incised wounds—one would search for bits of glass, etc.

2. **Contused and lacerated wounds.**—These are often the result of injury by means other than the employment of a weapon. Thus they may result from (1) Injuries by broken glass—broken-glass wounds, however, if slight, are apt to resemble incised wounds; (2) Falls on some projecting, more or less sharp object; (3) Injuries from wild animals; or

(4) Machinery and railway accidents. Severe contused and lacerated wounds are often accompanied by very little hæmorrhage due to (*a*) shock or (*b*) bursting or crushing of vessels.

Slight non-accidental lacerated wounds, produced without a weapon, may be the result of injuries inflicted in forcibly tearing out ornaments, or by the teeth or nails. If a wound of this class has been produced by a weapon, and much contusion or laceration is present, the indication, of course, is that a rounded or blunt-edged weapon has been used. Sharp-edged knives, it should be noted, if used with considerable force, cause bruising and laceration of the parts divided.[1]

Gunshot wounds resemble contused and lacerated wounds in character, and indicate, of course, the employment of a firearm, but not necessarily the discharge therefrom of a hard projectile. If the wound is single, it may have been caused by a firearm loaded with powder and wadding only, if the weapon has been discharged near the body. Nearness of the weapon to the body at the time of discharge is indicated by blackening of the skin from the gunpowder, except with cordite and modern gunpowder, or by scorching, charring, or blackening of the clothes at the seat of injury. A single wound, however, may be caused by a firearm loaded with a hard projectile, which in such a case will usually be found lodged in the wound, though a bullet may be so deflected by a bone, etc., as to pass round and out again by the entrance wound. Two orifices caused by the same discharge, indicate the employment of a hard projectile. When two orifices are present, the orifice of entry will usually be found to be smaller and more depressed than that of exit, which latter is usually ragged and everted. More than two orifices may be caused by one projectile, *e.g.* when this has entered the body after traversing a limb, or has split up against a sharp ridge of bone into two pieces, each finding a separate exit; or more than one orifice of exit may be caused by an intact bullet and a splinter of bone punched off by it. A wound in the neck, produced by a thrust with a "pointed perfectly circular bamboo," was mistaken for a gunshot wound.

In the case of a shot-gun wound, if the distance from which the gun is fired is within 12 inches, the wound will, as a rule, be single, while beyond this each shot will make a separate wound,[2] but it will depend also on the charge, size of shot, bore of weapon, and whether 'choke' or cylinder. A single pellet of shot may cause death by penetrating the aorta, or the brain through the eye. Fatal wounds may be caused by

[1] Ogston's *Lects. on Med. Jur.*, p. 420. [2] Casper, I. 266.

gunpowder and wadding alone if fired within about 4 inches from the body.

Contusions or bruises.—Under this term are included all degrees of injury produced by blows, kicks, or sudden pressure from explosions where the skin is not divided, ranging from a simple *bruise* on the surface of the body to one accompanied by fracture of underlying bones and rupture of internal organs.

In almost all contusions there is more or less extravasation of blood into the tissues constituting ecchymosis. The amount of blood effused is not entirely determined by the severity of the blow, but to some extent by the looseness of the particular tissues at the site of the blow, and by the condition of the blood of the individual, or the extensive effusion from a blow on the eye, and the bruises produced by a comparatively gentle grasp on flabby women with thin skins.

Ecchymosis shows itself as a dark, dull reddish-blue discoloration of the skin, which in about twenty-four hours begins to change colour, becoming lighter, and changing in tint to violet, then to green, and lastly to yellow, and finally disappears altogether in about five or six days. These changes in colour commence at the circumference of the patch, are due to varying degrees of solubility of the pigments into which the hæmoglobin breaks up, and to dilution of the effused blood by the serum of the cellular tissue and subsequent absorption, and occur only during life.

Superficial ecchymosis.—This appears within a few minutes after the injury, and is first of a bluish-black colour. When fading it passes through the chromatic changes from the periphery of zones of brown, green, and yellow, due to changes in the hæmoglobin.

Deep ecchymosis.—This may not appear on the surface for several days after the injury, and not always directly over the site of injury. Where there is yet no discoloration of skin, the effused blood may be detected by palpation.

Ecchymosis (*a*) may occur at a distance from the spot to which violence has been applied, *e.g.* at the seat of fracture of a bone broken by indirect violence; (*b*) may occur in spots (petechiæ), and as large extravasations indistinguishable from bruises, but without violence in some diseases, *e.g.* scurvy, and some cases of snake poisoning; (*c*) other things being equal, is in amount less, the better the bodily condition of the individual injured, and greater the looser the texture of the skin at the seat of injury; lastly, (*d*) its disappearance during life is apt to be extremely slow in old persons; is more rapid the better the bodily condition of the sufferer. After death, it may disappear from, or be masked by decomposition, or the application of antiseptic agents (*e.g.* charcoal) to the body.

It may be absent in moral injuries, especially when the violence has been applied to a yielding part, *e.g.* the anterior abdominal wall, as by a blow or kick, or the passing of a cart-wheel over the body. In the absence of ecchymosis, the fact of the existence of an internal injury caused by

external violence is, during life, a matter of surgical diagnosis. After death, the existence of an internal solution of continuity may be ascertained by dissection, and, in the absence of ecchymosis, its connection with external violence is sometimes indicated by bruising of the parts lying between it and the surface. If such bruising is absent, as well as ecchymosis, the question whether or no the solution of continuity discovered has been caused by external violence, may be a difficult one to decide, requiring consideration of points such as (*a*) the freedom, or otherwise, from disease of the affected part; (*b*) the situation of the affected part, and its degree of liability to rupture from causes other than external violence; [1] and (*c*) the history of the case.

Cadaveric lividity, discoloration of the skin due to *post-mortem* staining may, to a certain extent, simulate ecchymosis, especially when this, owing to the pressure of a sheet or other covering on the body, occurs in stripes resembling marks of flogging. It, however, (*a*) affects dependent parts; (*b*) is usually of great extent; and (*c*) is unaccompanied by extravasation of blood. An incision through the skin and examination of the underlying cellular tissue, therefore, will always disclose the true nature of the discoloration. Attempts are sometimes made to simulate ecchymosis by applying marking nut juice, or some other irritant, to the skin; such applications, however, usually produce blistering, or a papular eruption, easily distinguished from ecchymosis.

The weapon in contusions.—If a weapon has been used, it will probably have been a blunt or rounded one, such as a stick or club. Frequently the shape, etc., of the weapon or instrument employed can be inferred from the shape and situation of the patch or patches of ecchymosis. Weapons commonly employed in India in the production of severe injuries of this class are: (1) a **bamboo staff** or club, often bound with iron (**lathi** or *sonta*), or when bound with iron (*lohabandi*). Harvey [2] mentions that about 32 per cent. of the medico-legal cases reported in Bengal, etc., during the three years ending 1872 were *lathi* wounds; and (2) the rice-pounder, a club usually of hard wood about 3½ feet long, and 1½ to 2 inches in diameter, shod at one end with a thin iron plate about 1½ to 1 inch long. This latter is a common weapon of assault in the Madras Presidency. Instruments more or less frequently used in India in producing slight injuries of this class, requiring special mention are, (1) **shoes**—beating with a shoe is supposed to add insult to the injury; and (2) **ropes** or cords, used either for the purpose of tying up the sufferer as a mode of torture, or to secure the victim during the infliction of other injuries. Usually the arms are secured behind the back by binding together the elbows or wrists. The **split-cane** (*bet*) used in Assam and Burma, for tying bundles, often makes a clean-cut wound. In the mangling form of torture by **bamboo-crushing** (*bansdola*), in which a bamboo on which men are

[1] See injuries to the brain, thorax, abdomen, etc., pp. 119 *et seq.*
[2] *Bengal Med. Leg. Rep.*, 1870–72, p. 20.

sitting is rolled backwards and forwards over the chest, there may be no external mark of violence or bruising yet the ribs may be broken and the lungs lacerated, as recorded by Chevers.

3. **Punctured wounds.**—Punctured wounds may be caused accidentally by projecting nails, fragments of crockery, etc. If the edges of the puncture are free from laceration or contusion, the indication is that a sharp-pointed weapon has been employed. Sometimes, but not always, the shape of the weapon which has been used is indicated by the shape of the puncture in the skin. Dupuytren found, however, that cylindrical pins produce elongated openings.[1] The obliquity or directness of the thrust, and also the state of tension or relaxation of the skin, may affect the shape of the puncture, and hence two punctures from the same weapon may differ in shape. Very often also, owing to the elasticity of the skin, a punctured wound is of less diameter than the weapon which has been used. Sometimes in a punctured wound, the broken-off point of the weapon employed is found. Punctured wounds are occasionally found in concealed situations, *e.g.* in the rectum or vagina, in the armpit, or under the upper eyelid. A minute puncture in certain situations, *e.g.* over the fontanelles in infants, or in the nape of the neck, may indicate a mortal wound. The existence of several punctured wounds of course very strongly indicates the employment of a weapon, and if all are similar in size and shape the probabilities are in favour of their being due to repeated thrusts with the same weapon.

The weapons in punctured wounds used in India, besides knives and weapons of the bill-hook class already mentioned, are (1) daggers (*katari*), of various shapes—in some of these the handle is transverse to the axis of the blade; (2) the spear (*bhalam, barchi* or *sulfi*); (3) arrows (*tir*); (4) sickle (*haswa*). Arrow wounds, it may be pointed out, are frequently fatal.

In Bengal, etc., in the three years ending 1872, there were fifteen fatal cases out of a total of twenty-five. The case below illustrates the great penetrative power frequently imparted to these projectiles. The pickaxe (*gainti*), hoe-fork (*kanta-kudáli*) may also cause a punctured wound, probably with much contusion; and punctured wounds may be produced by thrusts with a pointed bamboo.

Case.—Arrow wound.—A Hindu female, aged fifty. An arrow, having first passed through the fleshy portion of the right forearm, had penetrated the chest between the eighth and ninth ribs, and was sticking in the body. On opening the chest the arrow was found to have passed through the diaphragm, having slightly cut the upper surface of

[1] *Bengal Med. Leg. Rep.*, 1870–72, p. 416.

the right lobe of the liver, pierced through the lower lobe of the right lung, and penetrated about an inch into the spine behind the heart and root of the lung. There was a large quantity of fluid and clotted blood to the right of the spine, but the heart was uninjured.—*Ind. Med. Gaz.*, 1875, p. 257, Dr. S. Manook.

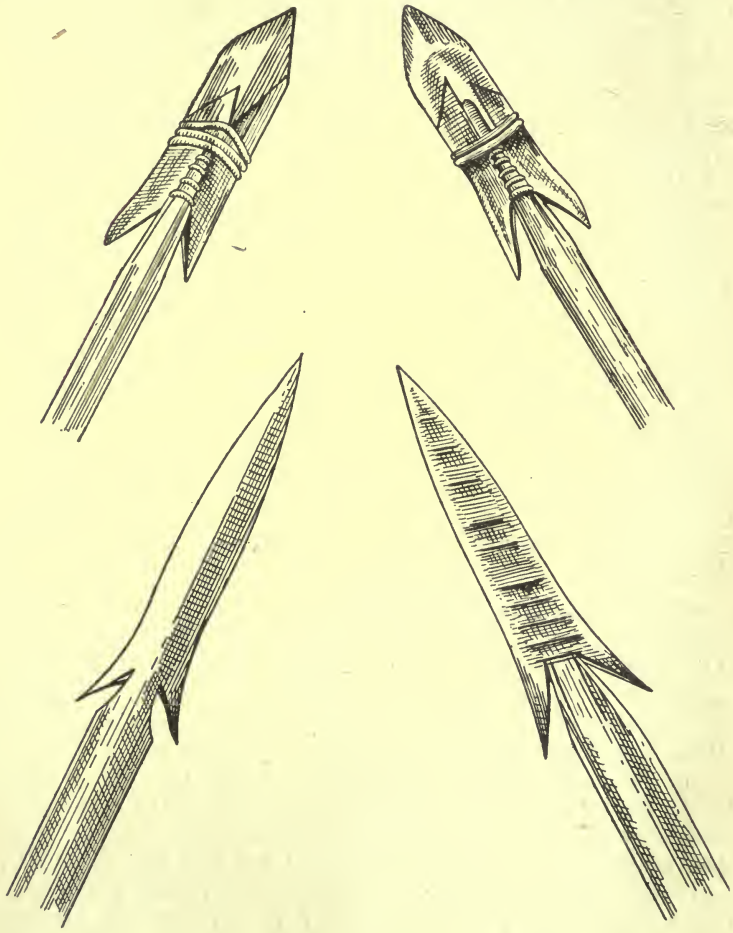


FIG. 11.—Poisoned Arrows of Aka Tribe.
(Half actual size. From a drawing by L. A. Waddell.)

Same weapon may cause wounds of different classes.—A heavy weapon of the bill-hook class may, for example, produce all four varieties. Hence the existence on the body of the same individual of wounds belonging to two or more of these

four classes, does not necessarily indicate that two or more weapons were employed, or that more than one person was concerned in their infliction.

Injuries by animals may produce wounds of any of the above classes. —Injuries without visible solution of continuity, often severe enough to cause death, are sometimes caused by elephants kicking, trampling on, or butting the injured individual, or by the animal seizing the individual with his trunk and dashing him forcibly on the ground. Apparently incised wounds may be caused by the tusks of the wild boar. Harvey describes such wounds as "long, clean rips," and mentions a case in which a wound so produced, on the inside of the left thigh, was twelve inches long, three deep, and one broad, and, dividing the femoral arteries, caused death by hæmorrhage. Fatal contused and lacerated wounds may be caused by various animals; thus they may result from a bite, or from a blow with the paw, or from injury by the claws, of an animal of the tiger class, in which case the neck is often the seat of injury; or they may be the result of a bite from a crocodile, or of an injury inflicted by a bear, in which last case the scalp is often found greatly torn. Again, contused and lacerated wounds may be the result of injuries inflicted by domestic animals, *e.g.* a kick or bite from a horse or cow. Punctured and lacerated wounds may be caused by the tusks, or more frequently by the horns, of animals. In Bengal, etc., in three years, twenty cases of gores by horned cattle, ten of them fatal, were reported. On the whole, injuries caused by animals are so characteristic in appearance that there is seldom any difficulty in deciding as to their origin.

Case.—**Kicked to death yet no external marks.**—A woman was kicked to death by her husband. Her body was found by neighbours and a doctor called who reported no marks of violence, and death probably due to natural causes. A *post mortem* was made and the sternum found fractured in both places, and two days later a second *post mortem* was made when extensive discoloration of the back noticed and thought at first to be *pus*-staining. The discoloured patches were incised and subcutaneous extravasations found which were traced to multiple fractures of the ribs about their angles. These fractures were not discovered at the first *post mortem* and it is therefore likely if the sternum had not been fractured a crime would not have been suspected.—F. Crookshank, *Trans. Med. Leg. Soc.*, 1909, 19.

4. **Internal injuries without visible wound.**—These may be accompanied by serious internal solutions of continuity, *e.g.* fractures of bones, or rupture of some internal organ (see p. 119, etc.) such as the spleen, and hence may be of any degree of severity, from extremely slight to mortal wounds.

Case.—In 1884, when the insane Rajah of *Kolapur* died suddenly after a struggle and fall from his keeper, it was found that several ribs were broken without any external marks.

Examination of Wound Cases.

The following points should be noted in all Wound Cases **in the Living** as well as in the dead.[1]

[1] Modified from F. J. Smith's *Med. Jur.*, p. 156.

1. Kind (incised, lacerated, punctured, bruised, etc.)	With reference to kind of weapon (and degree of offence), danger to life.
2. Number	With reference to self-infliction, evidence of struggle, kind of weapon, shock and hæmorrhage, etc.
3. Position on body	With reference to self-infliction, danger to life.
4. Direction and organ wounded ...	With reference to danger to life, how inflicted.
5. Size (length and breadth) ...	With reference to how inflicted, danger to life.
6. Depth	With reference to danger to life and self-infliction.
7. Edges and ends	With reference to kind of weapon.
8. Foreign bodies present	With reference to how inflicted, bits of glass, hair, dirt, etc.
9. Hæmorrhage amount	With reference to danger to life.
10. Inflammatory reactions ...	With reference to time inflicted, *ante-* or *post-mortem*.
11. Cuts and stains on garments ...	With reference to kind of weapon, how inflicted, etc.

In wounds in the Dead, in addition to the above, carefully examine and note down the appearance of the wound without disturbing the latter, and photograph it if possible. Note amount of blood effused and the presence of spirted blood-stains on objects in the neighbourhood where the injury was received. Whether the blood is coagulated, and firmly so; presence of *rigor mortis* and *post mortem* stains. Then the interior of the wound may be examined as to clots; and in stab cases the direction and depth explored gently by a blunt bougie, the deeper course of the wound is to be exposed by dissection without interfering with the external wounds which should be preserved for comparison with the alleged weapon. If a bone is injured, the injured portion should be removed as evidence.

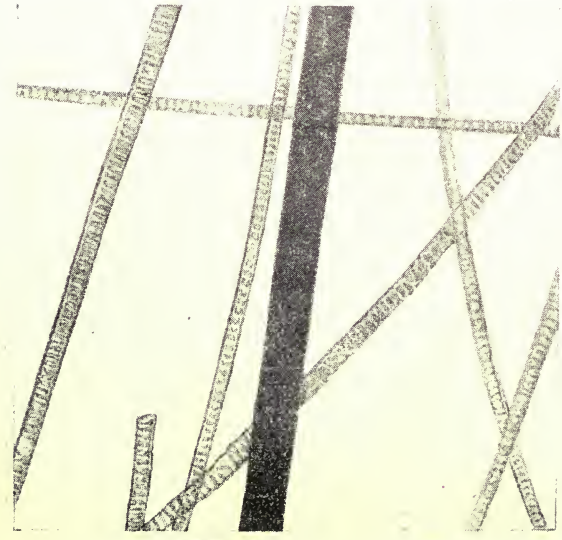
Artificial Bruises in Malingering and for False Evidence.

The appearance of bruises and blisters is sometimes produced by malingerers or for false evidence in India by the application of the common weed Lal Chitra (*Plumbago rosea* or *Zeylanioa*).

Case.—**Artificial "Bruises" by Lal Chitra.**—In 1912 two undertrial prisoners, accused of murder, while confined in the Jhenidah Sub-jail, brought a charge of torture against two constables and a Sub-Inspector of Sailkura p.-s., one of them complained of having been branded with a pair of hot tongs (*chimta*) and the other of having been assaulted. In support of the charge they showed marks on their persons.

Mr. Quarry, Superintendent of Police of Jessore, inquired into the

a.—Human Hair × 130.



b.—Cat's Hair × 130.

c.—Guinea-pig's Hair × 130.

(From Micro-Photographs by Dr. H. Gibbes.)

[*To face p.* 114.

charge and was satisfied that no assault had been committed. The marks on the body of the prisoners were in Mr. Quarry's opinion caused by the use of certain plants common in the locality—probably with the connivance of the jail warders. In support of this supposition he cited the following instances: In 1911 when he was at Bhagalpur two prisoners, some three days after their admission to the Bhagalpur Jail, brought a charge of assault against the Police, and in support of their complaint showed some injuries. The Jail Doctor and the Civil Surgeon were both of opinion that the marks on the person of the prisoners were caused by beating with a stick some ten days before the examination. The Superintendent of Police in the presence of Mr. Quarry marked thearm of a head-constable with a seed (Latin name *Semecarpus Anacardium;* Bengali name Bhela) commonly used by *Dhobis* for marking clothes. The following morning the Collector, the Superintendent of Police, and the two doctors mentioned above met and the head-constable was examined. Both the doctors expressed a decided opinion that the marks on the head-constable were bruises caused by beating some ten days before the examination.

Mr. Quarry while at Jhenidah heard of a plant which, if touched, would leave a mark like a bruise. He sent for a stem of this plant, and it was brought to him within half an hour, which shows that it is a common plant and is not difficult to find. With the stem he just touched the forearm of a constable and within an hour there was a nasty-looking bruise just as if the man had been struck with a cane. Five days after he took the constable to the Civil Surgeon, who assured Mr. Quarry that the man must have been struck with some instrument like a cane about a week before the examination.—Lal Chitra produces such effects.[1]

Evidence from Foreign Bodies.

Foreign bodies found in the wound: such as broken pieces of glass, splinters of bamboo or other wood may indicate the means by which a wound was caused, also the broken-off point of a knife or dagger, or the projectile or wadding or pellets of gunpowder of a firearm. Deep punctured and gunshot wounds should specially be searched for foreign bodies of this latter description, and, if found, should be preserved for production in court, as they are frequently of great importance as links in a chain of evidence. For example, the broken-off point of a knife found in a wound, may exactly fit a knife alleged to have been used, or this may have a perfect point, showing that it was not the weapon employed. Again, a projectile found in a gunshot wound may fit, or be too large to have been discharged from, the firearm alleged to have been used; or a piece of paper or cloth, used as wadding, and found in a gunshot wound, may correspond to similar fragments found in possession of the accused. Foreign bodies are not always found in gunshot wounds; a projectile, for example, may have completely traversed the body or may have lodged and subsequently dropped out, as sometimes happens when the wound is shallow,

[1] *Bengal Criminal Intellig. Gaz.*, Feb. 11, 1916.

or when a portion of clothing has been carried into the wound with the projectile.

For detecting foreign bodies in wounds and for the existence and particulars of fractures the Roentgen rays may be used. X-rays photographs are admissible as evidence in medico-legal cases; but the 'skiagram radiograph,' being only a *shadow* picture, is liable to distort the truth unless it is carefully made and its details are interpreted by skilled persons.

Thus rachitic changes may simulate injury of bone, and injury of bone not to be shown in certain planes. It does not show injury to the soft tissues. Radiographs should be taken in two different planes and at definitely marked distances. As evidence, the radiograph should have marked upon it the side of the body and the part photographed and also the part of the body in contact with the plate. It is well to have a radiograph of the corresponding limb or part for 'control' purposes. When a radiograph is produced as evidence the defendant should demand the privilege of employing expert testimony to explain its meaning to the judge and jury.

Evidence from Alleged Weapon.

The alleged weapon may affect the question of the guilt or innocence of the accused. Thus the character of the injury may show that it could not have been caused by the weapon produced by the prosecution. The alleged weapon should be compared with the wounds themselves, and with any cuts on the clothes. It should also be examined for stains of blood, adhering fragments of hair, etc. If a firearm, it may show signs of recent discharge. Recently discharged firearms will be found blackened inside the barrel, from the residue left by the gunpowder after ignition. This residue consists mainly of finely divided carbon and potassium sulphide, and yields to water a dark-coloured liquid, alkaline in reaction, and which, after filtration, strikes a black colour with a solution of a lead salt. After a time the potassium sulphide becomes oxidized into potassium sulphate, rust (hydrated ferric oxide) also forming. Hence, owing to the oxidation of the sulphide into a sulphate, washings from a firearm which has been some time discharged, may show no alkaline reaction, and give no blackening with lead salts. The 'fouling' of the modern gunpowders, cordite, etc., is different. Again, the weapon alleged to have been used may show signs of recent fracture, or be bent or otherwise injured as the result of its use.

Wounds in Living. Is Wound dangerous to Life?

This information may be required in cases, especially where the question of bail is being entertained, as bail cannot be

BULLETS AND FOREIGN BODIES FROM WOUNDS.

(After Major N. Mackworth, I.M.S.)

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granted where the probability of a charge for murder or criminal manslaughter arises.

The Danger to Life *primarily* depends mainly on[1] (*a*) the Amount of Hæmorrhage, (*b*) the Organ wounded, and (*c*) Shock; and secondarily on the probability of (*a*) Secondary Hæmorrhage, (*b*) Septicæmia, Erysipelas, Tetanus, and Scarring causing stricture of æsophagus, bowel, etc. There arises here also the question of pre-existing disease as a contributory factor.

On the question whether the wound is likely to leave any serious Personal Disablement, see chapter on "Insurance and Compensation for Accidents," though this information may also be required in criminal cases.

Wounds in Dead. Was Injury inflicted during Life or after Death?

Injuries inflicted after death, although often the result of accident, may also be the result of design, the motive being either concealment of a crime, or fabrication of evidence in support of a false charge. Further, the fact that an injury severe enough to cause death was inflicted during life, is evidence in favour of its having been the cause of death. Hence the importance of this question.

Case.—**Fabricating wounds** and mutilating bodies of the dead.—Decapitation is done by the rest of a gang to prevent identification in cases of wounded or killed thieves as related by Chevers, or the mutilation may be done with a dead body to fabricate a false charge of murder against a particular party. Thus in the *Nizamat Adalat Report* for Bengal, Vol. VI. 1856, p. 834, and 1855, p. 180, a case is reported from Tirhut. The body of a deaf and dumb beggar who had died of disease was found fearfully hacked and cut, leaning against the house of a person against whom the accused had a grudge. Four persons were convicted by the judge, but were acquitted by the higher court. For some other instances of mutilation, see Chevers, *Med. Jur.*, 479 to 500.

Ante mortem injuries are distinguished from *post mortem* injuries by the presence of signs indicative of vital action. These may conveniently be considered under the heads of (1) Ecchymosis; (2) Effusion of blood; (3) Other signs.

1. **Ecchymosis.**—Contusions inflicted during life, if severe, are generally, but not invariably, followed by ecchymosis. Ecchymosis may appear even if the individual has lived only a very short time after receipt of the injury; and further, ecchymosis from blows inflicted during life may not appear until after death has taken place. The presence of ecchymosis,

[1] Modified from Dr. F. J. Smith's *Medical Jurisprudence*, p. 182.

however, does not necessarily indicate that the injury producing it was inflicted during life. Christison found that blows inflicted on dead bodies, within two or three hours after death, were followed by ecchymosis, not distinguishable from ecchymosis the result of blows inflicted during life. If the individual has lived for some time, say more than twenty-four hours after receiving the injury, changes in colour will probably be found at the circumference of the ecchymosed patch, from purple to black, violet-green to yellow—thus affording a clue to length of time inflicted. Thus the purplish-black becomes by the third day violet, by the fifth day green, and by eighth to tenth day yellow, and the injured part will probably be found swollen. The presence at the circumference of the ecchymosed patch of changes in colour of the above kind and the presence of swelling of the injured part, show that the injury was inflicted some time before death.

2. **Effusion of blood.**—In a dead body the blood remains fluid for some time after death, rarely beginning to coagulate until four hours, and sometimes not until twelve hours, after death. Hence an injury inflicted after death, while the blood is still fluid, may be followed by effusion of blood. Owing, however, to arrest of the heart's action, no arterial spouting occurs, and the quantity of blood effused is much less than would be effused from a similar injury inflicted during life. Further, blood effused from a wound, made more than ten minutes after death, rarely coagulates. Hence, marks of arterial spouting indicate infliction while the heart is beating. Much hæmorrhage also indicates *ante mortem* infliction, and if the blood effused is found coagulated, the presumption is strong that the injury was inflicted either during life, or very shortly after death. *Post mortem* infliction is indicated if the effused blood is found fluid, but not necessarily by the quantity of effused blood being small, seeing that severe contused and lacerated wounds, inflicted during life, are sometimes followed by but little hæmorrhage.

3. **Retraction and eversion** of the edges of wound follow the infliction of an incised wound made during life or shortly after death. Wounds other than incised wounds, inflicted during life, exhibit this character in proportion to the closeness with which they approximate in nature to incised wounds. Hence in incised wounds, or wounds approaching in character to incised wounds, indications of infliction during life, or shortly after death, are:—(*a*) retraction and eversion of the edges of the wound; (*b*) hæmorrhage into the wound, and into the

cellular tissue around it; and (*c*) the presence of coagula. In throat wounds, Dr. A. Powell has remarked inversion of the edges in the wounds due to the retraction of the platysma muscle in the cut skin.

Summary of *Ante* or *Post Mortem* Infliction.

	Indicate infliction	
Signs of inflammation around injury Discoloration at circumference		**Certainly before,** and probably 24 hours before, death
Marks of arterial spouting Extensive hæmorrhage		**Before** death
Coagula		**During** life, or very shortly after death
Retraction and eversion of the edges of the wound Ecchymosis		**During** life, or probably not more than three hours after death
Complete absence of all the above characters		Probably more than twelve hours **after** death

Special Wounds according to Regions: Head Wounds.

Scalp.—Contused and lacerated, and even apparently incised wounds penetrating to the skull are especially likely to follow blows from blunt weapons on the scalp. Occasionally from such blows, the inner surface of the scalp is found ruptured without there being any rupture of the outer surface. Wounds of the scalp only are not likely to cause danger to life, except from the supervention of inflammation and erysipelas. Other things being equal, these are more likely to follow contused and lacerated, than clean-cut wounds. Erysipelatous inflammation, although a common sequel of scalp wounds in temperate climates, appears rarely to follow such wounds in India. On the other hand, the scalp may seem uninjured, yet the brain may be injured by fracture of the skull or concussion or hæmorrhage.

Skull.—Separation of the sutures without fracture may occur, even in old persons, from mechanical violence. Harvey records sixteen cases—one an old man of seventy—in which this was the result of *lathi* blows. Fractures of the skull may be simple or compound, direct or indirect. Simple fracture is a usual result of a fall on a flat surface, while fractures from blows with blunt weapons are, unless the head is protected by a thick turban or some similar covering, usually compound. Fractures from blows with blunt weapons are in the great majority of cases direct, *i.e.* at the site of the blow. Indirect fracture, *i.e.*

fracture by counterstroke, common as a result of falls, is comparatively rare as a result of blows with weapons. In fractures of the skull the danger to life mainly depends on the amount of injury to the brain; and other things being equal, the amount of such injury is likely to be greater, the thinner the bones at the seat of fracture. Hence blows on the temple and punctured wounds of the orbit are specially likely to be attended with danger to life.

Case.—**Pounding of skull.**—At Almora a robbery case is reported by Lt.-Col. L. A. Waddell, in 1901, in which the skull of the victim was smashed in and almost pulpified by beating with a large stone.

Sword-cuts of skull are especially common amongst the excitable Burmese, who use their heavy cleaving *dahs* on slight provocation. In these cuts a shaving of the skull and scalp may be sliced off, or nearly so, by a glancing cut; but the most serious are vertical wounds fracturing one or both tables of the skull and those accompanied by depression of the skull and injury to the brain substance. In the vertical wounds the inner table is frequently fractured, although there may at first be an absence of head symptoms.[1] One of the worst instances of extensive sword-cuts of the skull is the Jhelum case, here cited.

Case.—**Multiple sword-cuts** through skull and other bones.—A tragedy is reported by Lt.-Col. L. A. Waddell from Jhelum in May, 1881, where he saw a *sais* (groom) caught red-handed in the act of killing his wife and her paramour with an Afghan sword, inflicting remarkably extensive cuts through bones, in which the latter were sliced through almost as if they were cheese. The wife endeavouring to save her paramour received a cut which bisected the left side of her chest from the spine to the sternum as if the thorax were sawn through in half, cutting through the ribs, spinal column and vertebræ, across left lung and into the heart. The same cut also severed both bones of the right forearm above the wrist, which had been clasping her paramour, and the hand was left hanging only by about two inches of skin. Death was instantaneous in a pool of blood. Turning to the man, the infuriated *sais* dealt him a cut at his head, which nearly sliced off the whole top of the skull with its contained brain, the cut extended from above the level of the eyebrows transversely through the skull and brain to the other side, leaving only about three inches of the skull uncut to complete the circuit. The same sword-cut also cut into the man's axilla incising several ribs, as the man had ducked his head and was protecting it by his uplifted arm. After the man fell the *sais* nearly severed the remaining portion of the head from the body by two cuts, one of which sliced off the angle of right lower jaw and the other cut through the neck down cervical spine. The sword was one-edged and exhibited after the tragedy a somewhat sinuous edge, through being wrenched out of the cut bone into which it had become embedded. The *sais* was a muscular, middle-aged

[1] C. C. Barry, *Ind. Med. Gaz.*, 1901, 377.

man, who had no experience in wielding a sword. He made no attempt to deny the crime, but pleaded provocation. He suffered the death penalty.

Brain.—Injury to the brain frequently follows a fracture, especially a depressed fracture, of the skull, and, as stated above, is the main source of danger in such fractures. Injury to the brain may, however, occur without fracture of the skull, and sometimes results from a comparatively slight blow on the head. As in the case of fracture of the skull by counterstroke, the seat of the injury to the brain may be at a point opposite to the spot to which the violence was applied. The brain injury may be a *contusion followed by concussion.* An injury of this kind may prove immediately fatal, or produce temporary insensibility, which may closely resemble intoxication, and be only distinguishable from it by the absence of alcoholic odour in the breath; or may produce only slight immediate effects, but be followed after an interval by inflammation, ending in death. Guy, for example, mentions the case of a woman who received an injury on the head, and after remaining well for twelve days, fell ill and died with symptoms of compression; and also the case of a girl who, after a fall on the head, suffered simply from headache for six weeks, but died two months after the fall from brain affection. The injury may be *compression,* caused by depressed bone, effused blood, or the products of inflammation. The brain is specially likely to be injured by depressed bone, in punctured fractures, and in fractures in situations where the bones are thin.

Effusion of blood on the surface, or into the substance of the brain, may occur with or without fracture of the skull, and may cause immediate insensibility, followed by death in a few minutes, or, when the effusion occurs slowly, insensibility may not set in for an hour or more. The middle meningeal artery is frequently ruptured, as a common occurrence, with or without fracture of the bone, as a result of a fall or blow. Often there is no immediate unconsciousness or only a momentary stunning, after which the patient may walk many miles and transact his business. Later, perhaps some hours later, effusion takes place between the *dura* and the skull, perhaps accelerated by some stimulant or excitement. Coma sets in as a result of compression, and the patient dies unless surgically treated. Coroners' juries frequently censure house surgeons who have failed to recognize such cases and to detain them in hospital. Professor Powell has held autopsis on three such cases in the practice of one house surgeon who had not correctly diagnosed any of them. Effusion of blood from violence *without fracture*

of the skull, may or may not be accompanied by appearances of contusion of the integuments covering the skull. If accompanied by such appearances, the question may arise whether the effusion was the result of the external violence which gave rise to these appearances, or the result of disease or excitement. A similar question also may arise even in cases where no marks of external violence are apparent, as effusions of blood from violence may occur without any external signs of injury being present. An effusion of blood from violence is generally, unless the brain itself be torn, on the surface, and not in the substance, of the brain. It is commonly located immediately below the seat of violence, but in some cases is found at a point directly opposite thereto. Effusion of blood from *disease or excitement* is sometimes extremely difficult to distinguish from effusion caused by violence. From disease, however, effusion rarely occurs in persons under the age of forty; most commonly takes place in the substance of the brain, and careful examination will generally disclose a diseased condition of the vessels. Effusion from excitement—alcoholic or non-alcoholic—may occur in persons of any age. Signs of congestion of the cerebral vessels co-existing with effusion, are to a certain extent in favour of disease or excitement being its cause. It must further be pointed out that even if the probabilities are in favour of an effusion being due to violence, the question may still arise whether the violence was a blow, or the result of a fall. Questions of this kind not infrequently arise in the case of a fight between intoxicated persons. Blows are interchanged; the individuals perhaps are separated; one of them is then seen to stagger and fall, becomes insensible, and dies. *Post mortem* examination shows the cause of death to be effusion of blood on the surface, or into the substance of the brain. In such a case it is often difficult in the extreme to arrive at a definite conclusion on the question as to whether the effusion of blood was the result of (*a*) a blow received during the fight, or (*b*) excitement or disease, or (*c*) the fall after the termination of the struggle. *Compression* from the products of inflammation may set in and prove fatal several days or weeks after receipt of the injury.

Lacerations of the brain may be caused by a weapon or projectile penetrating the skull, or by fragments of depressed bone; or may occur without injury to the skull, either immediately below, or at a point directly opposite to, the seat of the violence. Wounds of the brain are, of course, attended by great danger to life. Very severe wounds of the brain, accompanied even by loss of substance, may not cause immediate

death, or even immediate insensibility, and in exceptional cases recovery may take place.

Face.—Wounds of the face are not likely to be dangerous to life unless the orbit is involved or the injury or resulting inflammation extends to the brain. Injuries to the face by causing permanent disfiguration, loss of sight, or teeth, etc., often come within the definition of 'grievous hurt.' Slitting or cutting off the nose is a recognized punishment for unfaithful wives, who after the operation are described as '*Nakti*' or 'nosed.' Often when the victim is a female the lips or breasts are also wounded, but no other injury may be present, indicating either submission of the sufferer to the punishment, or the participation of several persons in the outrage. When the victim is a male the motive is commonly either sexual, or punishment for theft; or, if the teeth have been employed, the injury may have been inflicted in the course of a struggle, and indicate no special motive. Injuries to the nose and ears caused by forcibly pulling out ornaments are not uncommon, especially in females, and may, by causing permanent disfiguration, amount to grievous hurt. In such cases the motive may either be theft, or desire to cause hurt. Injuries to the eyes also are not uncommon, and may be the result of direct violence, *e.g.* gouging out by the fingers, or injury by a sharp-pointed weapon, the motive for infliction of the injury being similar to those leading to wounds of the nose or ears. Or the injury may be the result of indirect violence, and indicate no special motive. As examples of injury to the eyes from indirect violence, it may be mentioned that blows with a club on the head sometimes cause rupture of the eyeball; and wounds of the eyebrows are sometimes followed by amaurosis.

Cases.—**Gouging out the eyes.**—In 1854, a very brutal case was tried at Mangalore, in which the paramour of a married woman, becoming tired of her, or jealous, gouged out her eyes with a curved knife and a needle. The woman recovered.—*Faujdar Adalat*, 1854.

Chevers gives a case of a man who gouged out both the eyes of his wife with his fingers, and otherwise maltreated her, because she declined to have connection with him, being very young.

In Macnaghten's Reports, Vol. II., 427, a case is given of a man who, having tied the hands and feet of his wife, threw her down, sat upon her breast, and put out her eyes with a heated iron. In the case of bodies found exposed in the fields or jungle, it should be remembered that the eyes are generally the parts first attacked by birds of prey.

The loss of a tooth from a blow is a common complaint, but it is usually false and intended to establish a charge of 'grievous hurt.' The knocking out of teeth is rather rare in

India, as the fist is seldom used for assaults. When blows are delivered over the mouth or eyes it is usually with a shoe. In false cases there will likely be no signs of injury to lips or gums or adjacent teeth, although the alleged weapon is usually a thick *lathi*, or a large stone, the cavity is usually old and contracted, and the teeth of complainants, usually an old man or old woman, are generally loose. The incisor tooth produced in such false charges is usually unbroken, and old and dry.[1]

Spine and Spinal Cord.

Generally the danger is in proportion to the extent of spine injured. Death occurs instantaneously if the medulla and upper part of the cord be wounded. Serious injuries to the cord above the third cervical vertebra are immediately fatal from paralysis of the muscles of respiration. Serious injuries lower down give rise to secondary effects, from which death may follow long after the receipt of the injury. Injury to the spinal cord may occur without fracture or dislocation of the vertebræ. A blow, for example, on the spine, may cause concussion of the cord followed by paralysis, or may set up inflammation followed by softening of the cord.

Concussion of the cord sometimes results from a railway accident, and in actions for damages in cases where this injury is alleged to have been received, the question whether the plaintiff's symptoms resulted from the accident or from disease, or are pure malingering, is sometimes a very difficult one to deal with.

Fracture of the second cervical vertebra with displacement and immediate death, is a not infrequent result of a fall from a height on the vertex. If the bones or ligaments are diseased, very slight violence may cause displacement and fatal injury to the cord, and Taylor mentions a case in which displacement of the odontoid process, and fatal injury to the cord, appear to have been caused simply by the muscular effort of throwing the head forcibly back. Fatal injury to the cord from non-accidental violence may be caused without a weapon. Fatal fracture of diseased vertebræ has resulted in several cases from the well-meaning but ignorant efforts of bonesetters. Fatal fracture—dislocation of the cervical vertebræ—has also resulted from reprehensible horseplay in lifting up children by the head "to show them London." In Urdu "to show them a deer" or "the children of the sun." Fatal injury to the

[1] W. D. Sutherland, *Ind. Med. Gaz.*, 1899, 241.

cord, unaccompanied by injury to any portion of the body other than the spine, is rare as a result of blows from blunt weapons, but may occur when the neck is the seat of the injury, and may even occur without any external marks of violence being present. In one of Harvey's cases, for example, a woman aged sixty was killed by a blow with a club on the neck. Death resulted from injury to the cord due to displacement of the vertebræ, but no external marks of violence could be seen, although on dissection blood was found effused into the muscles of the nape.

Case.—**Laceration of cord** without external injury.—This is a usual way of causing death in this country, especially in the case of children. The neck is twisted and dislocated, causing laceration of the spinal cord. In 1860 a woman was condemned to death, at Combaconum, for murdering a child in this manner, for the sake of stealing his jewels. There were in this case no external marks of violence.—*Madras Faujdari Adalat*, 1860.

Hacking the spine with a sword, bill-hook, or other heavy cutting weapon—causing sometimes decapitation—is a common mode of murder all over India, and specially so in the Central Provinces, Oudh, and the Panjab.

Neck Wounds.

Injuries of this region from mechanical violence other than the use of edged weapons, are chiefly dangerous to life from their effect on the spinal cord. A case cited by Harvey, however, shows that mechanical violence may cause very extensive, possibly fatal, injury to the soft parts in front of the neck without dividing the skin. Wounds of the neck from edged weapons are often suicidal, and often also homicidal. In cut throat, suicide is more or less contra-indicated, if the wounds are multiple, unless one only is severe; or if the wound is single and of great severity, more than sufficient to destroy life; or if the wound is low down on the neck. Wounds of the neck vary in danger to life according to their situation and depth. From the position of the large blood-vessels lateral wounds are more dangerous to life than wounds in front, and wounds low down on the neck more dangerous than wounds high up. Wounds of the windpipe only are attended with little danger to life. Wounds of the neck dividing the gullet are almost always fatal. Wounds of the large vessels are mortal injuries, death resulting either from hæmorrhage, or from entry of air into the circulation. Wounds of the carotids are not necessarily immediately fatal.

Case.—**Survival in cut throat.**—Chevers quotes a case in which a man, with the carotid artery divided, survived until the following day. It appeared that a man was aroused in the night by two thieves, who were in the act of stealing in the house. In the struggle which ensued one of them cut him in the neck, and they escaped. After receiving the cut, he said that he had seen the prisoners, whom he named, stealing his *goor*, that he had seized one of them, and that the other cut him on the neck with a *dhao*, or knife, and both made their escape. The accused not having come with the neighbours, were sent for and confronted with the wounded man, who accused them as above. The man's brother stated that the occurrence happened late at night, and that it was then moonlight. The man died the following day. The civil surgeon's evidence was as follows: "I found an irregular deep wound on the neck, apparently caused by the sharp, pointed instrument; the wound, in my opinion, was not caused by the man's own hand; the carotid artery was divided, and deceased had bled to death." It is to be regretted in this case that it is not recorded whether it was the *external* or the common carotid artery that was divided. If it was the latter, Chevers says that this is the only recorded case of so long a survival; but Taylor (ed. of 1883, Vol. I., p. 631) says: "There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and even running a certain distance."

Case.—Prof. Powell reports: "Ten years ago when driving to the Morgue, I observed a scuffle going on about sixty yards in front of me. A constable came running in my direction holding a handkerchief to his neck. I called out to him to attend to his business instead of running away from it, and took his number to report him. About an hour later his dead body was brought to the Morgue. He had been stabbed in the neck, and had run a distance of 80 yards before he fell. I found the right common carotid severed in two-thirds of its diameter."

Thorax Wounds.

Penetrating wounds of the chest perforating the heart or one of the large vessels, are mortal, but not necessarily immediately mortal, wounds. In such wounds the rapidity with which death occurs greatly depends on the rapidity with which hæmorrhage takes place.

Wounds of the heart may be penetrating or non-penetrating according as they injure the wall or penetrate the cavity. Ninety per cent. are penetrating. The chief dangers of the former are shock and injury to the coronary artery. A needle puncture rarely causes hæmorrhage from the ventricle, but from the auricle it does. Pericarditis, endocarditis, and empyæma are secondary complications. Loss of blood may occur comparatively slowly if a large vessel is only punctured, and the puncture is small; or if the heart is wounded, if the wound is small, or oblique in direction. After a wound of the heart an individual may even survive several days. Taylor

mentions two cases, one of survival for eleven days with a bullet one-third of an inch in diameter lodged in the septum between the ventricles; and another of survival for five weeks with a mass of wood lodged in the substance of the heart. Recovery may occur.

Taylor mentions that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others death took place from four to twenty-eight days.—See cases of recovery cited by Powell, *Ind. Med. Gaz.*, 1902.

Case.—**Wound of heart.**—A case narrated by Mr. William White of Rangoon.—"A soldier was wounded in the storming of the Great Pagoda on 14th April, 1852. The ball entered a little above the anterior fold of the left axilla, taking an oblique direction to the cavity of the chest. At first he appeared to be doing well, and the wound closed. Subsequently his health declined, with feverish symptoms and evidence of pulmonary disease. A few days before his death it was noticed that the action of the heart was weak but natural, its systole, or contraction, and diastole, or relaxation, regular and equal. He died worn out and emaciated on the 24th June. On examination, the bullet was found in the left ventricle of the heart, in its most interior part."—Chevers, *Med. Jur.*

Even when death occurs rapidly considerable power of locomotion may remain after receipt of a wound of the heart, as in the case already mentioned, where a man ran eighty yards after a stab penetrating the right ventricle. Taylor also mentions a case in which it is probable that a man ran over eighteen feet after a gunshot wound "shattering to atoms" the auricles and part of the aorta. If the lungs are wounded, death may occur rapidly from hæmorrhage, or after a time from inflammation, but wounds of the lungs are not necessarily mortal. A wound completely transfixing the chest, other things being equal, is not more dangerous than a simple penetrating wound.

Non-penetrating wounds and injuries of the thorax are dangerous to life in proportion to the amount of internal injury. Serious internal injuries of this class are usually, but not invariably, accompanied by fractures of the ribs, but fractures of the ribs may be present without other internal injury. If a rib has been fractured by direct violence, *e.g.* a blow from a blunt weapon, it is usually found broken in one place only, and the ends are driven inwards. When the fracture has been the result of indirect violence, the broken ends are usually driven outwards, and the fracture, if single, is generally at the point of greatest convexity. Ribs when fractured by indirect violence are often broken in two places, one in front and the other behind. Very often also when the violence is of the

nature of a force compressing the thorax, the fractures are symmetrical or nearly so, *i.e.* fracture of a rib on one side of the body is accompanied by fracture of the corresponding rib on the other side.

Compression of the thorax, causing symmetrical indirect fractures of the ribs, may be due to accidental violence, *e.g.* 'buffer-crushing' on railways, the fall of a heavy weight on the front of the chest, or more rarely to a fall from a height. More frequently it is the result of homicidal violence, and may be due to pressure with the knees, tramping underfoot, or to compression of the body between two bamboos, a process known as '*bans-dola.*' Again, it may be due to kneading with the knees and elbows, or '*kīl kanī*' (see also injuries to the liver). Dr. Harvey mentions a case in which symmetrical rib fractures were present, but no external marks of injury were to be seen on the chest, and suggests that in the case in question the compressing force was probably pressure with the knees.

Non-penetrating injuries of the thorax may injure the lungs or heart in falls from a height, compression of chest by falls of heavy weights, wheels, buffers, or by blows. If the lungs are injured, hæmothorax or inflammation, either of them ending fatally, may follow, even when there is no fracture of the ribs. Emphysema may be present, but this is only dangerous to life from mechanical impediment to respiration. The phrenic nerve was ruptured with instant death in nine cases reported by Dr. Coull Mackenzie (*Ind. Med. Gaz.*, 1889, p. 204).

Rupture of the heart is a comparatively rare result of non-penetrating chest injuries. Dr. Harvey mentions fourteen cases in the three years 1870–72, five of them homicidal, and in several the heart was healthy, but in most there was fracture of rib or sternum and external signs of violence. Dr. Coull Mackenzie describes five cases[1] of rupture of heart alone, one with rupture of spleen and one with rupture of other organs. The five former were caused by heavy weights falling and the other two by running over by laden carts. In four no external injury was visible, and in two no fractures of bones were present. Dr. Gibbons reports one case[2] caused by blow of a thin stick with death in three hours and without fracture of bones. Rupture of the heart may occur independently of external violence, or, if the heart is diseased, from a comparatively slight amount of violence. Again, external violence may cause rupture of an even healthy heart, and yet no

[1] *Ind. Med. Gaz.*, 1889. [2] *Ind. Med. Gaz.*, 1897, p. 443.

external marks of injury be present. Hence, when the heart is found ruptured and no marks, or slight marks only, of external violence are present, it may be difficult to say what was the cause of the rupture. Non-penetrating chest injuries may cause rupture of a large thoracic blood-vessel, *e.g.* of the pulmonary artery, pulmonary veins, or superior vena cava. Rupture of the diaphragm also may occur (see below).

Abdomen Wounds.

Penetrating wounds unaccompanied by any internal injury are, even if accompanied by protrusion of viscera, not necessarily fatal. Death when occurring rapidly is usually from shock, or after an interval from peritonitis. Moreover, such wounds, and also wounds or rupture of the diaphragm, are liable to be followed by hernia, and may hence (from strangulation) cause death indirectly, after a long interval. With a penetrating wound of the abdomen, there may be a wound of a vascular organ or large vessel leading to death from hæmorrhage; or a hollow viscus may be wounded and extravasation of its contents be followed by fatal peritonitis.

Fatal non-penetrating injuries of the abdomen may leave no external marks of violence. In some, but not all such cases, the tissues immediately underlying the skin at the seat of injury may on dissection be found to show signs of bruising and to contain extravasated blood. Blood, however, it must be recollected, may in rare cases be found extravasated in the muscles of the abdominal wall, without violence having been applied. Taylor[1] mentions two such cases; in both the extravasation was inside the muscles around the navel. A non-penetrating injury unaccompanied by any wound of the contents of the abdominal cavity may cause immediate death from shock. This is specially liable to occur from a blow over the region of the solar plexus, and in such a case, after death, no marks of violence, external or internal, may be discoverable.

Case.—**Death from a blow on the abdomen.**—Chevers quotes a case in which a man who was said to have been struck with a thick pole on the right loin died immediately. No trace of injury or of grave disease could be discovered on the most careful examination. "I therefore reported that, as blows inflicted upon the front of the abdomen had been known, in several instances, to cause death by a shock to the nervous system, it was probable that in this case like force applied to the side of the belly had acted in a similar manner."

[1] *Med. Jur.*, I. p. 667.

Or an injury of this class may cause death from peritonitis, in which case after death, no lesion other than signs of inflammation of the peritoneum may be found. More frequently the cause of death in fatal non-penetrating abdominal injuries is rupture of a viscus such as the spleen or liver. Rupture of a viscus, however, it must be recollected, may occur from *post mortem* violence, especially when decomposition is far advanced. An idea of the relative frequency of occurrence in India of rupture from violence of the different abdominal viscera may be gathered from the following figures. Among the fatal medico-legal cases reported in Bengal, etc., during the three years ending 1872, rupture of the spleen occurred in 564, liver in 129, bowels in 25, kidney in 24, urinary bladder in 8, and of the stomach in four or five cases.

Spleen.—Rupture of the spleen is of somewhat frequent occurrence in India,[1] especially in the more fever-saturated districts where the spleen is often much enlarged by disease,[2] and thus rendered liable to rupture from very slight violence. Indeed, the enlarged spleen sometimes undergoes **spontaneous rupture** with fatal results without the application of any external violence. The normal spleen of Indians as found by Prof. Powell in 2000 autopsies on Indians (omitting cases of malaria, plague, pneumonia and hæmorrhage) weighed a few grains under four ounces.

Cases.—(*a*) **Spontaneous rupture** of enlarged spleen.—Ali Bux, a fine-looking old Mohammedan, aged about 50 years, was engaged in a lawsuit in the Umballa court. In cross-questioning one of the witnesses, suddenly fell down and expired. The friends, who brought the body to the Civil Hospital, were emphatic that he had not received any blow or knock of

[1] Lt.-Col. D. G. Crawford's analysis of 304 cases of ruptured spleen showed that it occurred in 3·08 per cent. of the fatal cases sent by the police for medico-legal examination.—*Ind. Med. Gaz.*, 1902, p. 212.

[2] McLeod, quoted by Chevers, *Med. Jur.* (p. 462), points out that rupture of the spleen is liable to occur in cases of (1) simple engorged spleen; (2) hypertrophied engorged spleen; (3) small hard spleen; (4) large hard spleen. The normal form and size of spleen, according to Gray, are as follows: The spleen has two surfaces, one external and convex, the other internal and concave; two ends, the upper thick and rounded, the lower thin and pointed; and two margins, anterior and posterior, the former often being notched. Gray gives the normal size and weight of the adult (European) spleen as follows: length, about 5 inches; breadth, 3–4 inches; thickness, 1–1½ inch; weight about 7 oz. In natives of this country, whose size and weight is usually much less than those of Europeans, the weight and dimensions of the spleen should presumably be somewhat less than the above. But in many parts of Bengal normal spleens are less common than are enlarged, and the average size and weight of the spleens in the adult native of Bengal would probably be greater than those quoted above. The pathological cause of the enlargement is infection with either malaria or the 'Leishman-Donovan parasite.'

any kind, and an inspection of the court where he became faint, convinced me that there was no furniture or projecting angles where he could accidentally have knocked against something to cause internal injuries. Autopsy.—On opening the abdomen on 11th October, I found the peritoneal cavity full of a blood-stained fluid. There were also fresh blood-clots. The amount of the fluid could not be measured, but probably there were several pints. The spleen weighed 3 lbs. 13 ozs., and measured $9\frac{1}{2}$ inches by $6\frac{1}{2}$, and was $3\frac{1}{2}$ inches thick. On its inner surface, anterior to and parallel with the hilus, was a rent in the capsule, 6 inches in length. The opening was plugged with fresh black blood-clot. The substance of the spleen was soft and friable. There were no other injuries or signs of disease.—C. H. James, *Ind. Med. Gaz.*, 1902, p. 222.

(*b*) On 5th March, 1878, a beggar woman, Kamini, 30 years of age, who had been suffering from enlargement of the spleen for several years, at 3.30 o'clock in the morning complained of severe pain in her abdomen in the region of the spleen. No remedies were applied or given to her internally, and very shortly after she expired. At the autopsy on the same forenoon: The body was much emaciated, the abdomen

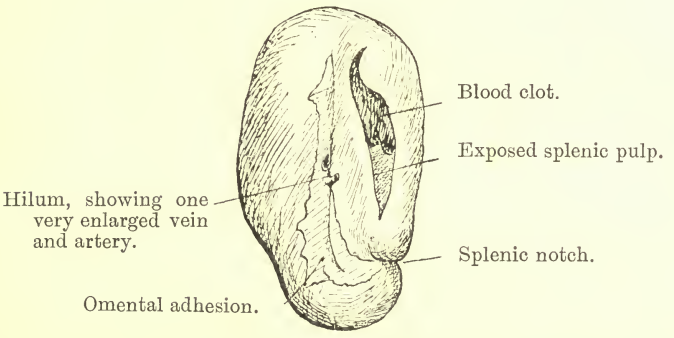


FIG. 12. –Showing Rent in the Spleen Capsule half-filled up with Blood-clot.

was somewhat enlarged, but there were no external marks of violence on it. The abdominal walls were not bruised. The liver was large, fatty and anæmic. The kidneys were fatty and anæmic. The other organs except spleen were healthy. The spleen was 12 inches long, 7 inches broad, and weighed 3 lbs. 14 ozs. Its substance was very hard, and there were two ruptures, each an inch long on the inner surface and lower end. There were several pints of serum in the abdominal cavity. There was 40 ozs. of dark blood of the colour and consistence of black currant jelly in and around the spleen. No bones were fractured.

(*c*) A native male of about 25, suffering from malarious fever and enlargement of spleen, on the evening of the 29th December, 1878, applied for medical relief at the dispensary of the Mayo Hospital. After receiving medicine he walked away slowly, with the assistance of a thick stick, along the bank of the river Hooghly for a distance of about half a mile to a landing-place; on reaching this spot he sat down, and shortly after had several convulsions, vomited a good deal, and died in about half an hour. I examined the body about 12 hours after death when I found it to be well nourished and to have no external marks of violence on it. The lungs were healthy, and there were extensive recent

pleuritic adhesions of the outer surface of the left lung to the inner surface of the thorax. The spleen was about 12 inches long, 8 inches broad at its lower and 3 inches at its upper end. It was hard. There were two ruptures on its inner surface and through its hilus, each 2 inches long. All the other internal organs were healthy and were anæmic. There was a large quantity of dark fluid blood extravasated into the abdominal cavity. I gave it as my opinion that the deceased died from spontaneous rupture of spleen.—Mackenzie, *Ind. Med. Gaz.*, 1889, p. 322.—Two further cases are published in the *Ind. Med. Gaz.*, 1904.

This liability of the enlarged spleen to be so easily ruptured is taken into account judicially in awarding punishment to cases where a blow, kick, etc., has caused death in this way. For so slight often is the force required to rupture a diseased spleen, that in many cases where this occurs from violence inflicted by another, there is no intention of causing death. In a few cases (8 out of 262) the ruptured spleen was not enlarged.

Cause of Rupture.—The rupture may be caused by accidental violence, *e.g.* a fall, or from the sufferer having been run over by a wheeled vehicle. In non-accidental cases it is often the result of a blow or a kick or a push against a wall or other hard body, without a weapon.

In 102 of the 247 cases of Dr. Crawford the cause was beating with a *lathi* or other heavy blunt instrument. Blows with fist, kicks or slaps or two or more of these combined accounted for 62, or over one-fifth. Falls from trees and in one case from a bridge gave 22 cases, 17 were run over by carts, and 23 were said to have been murdered.

A trivial blow may cause fatal rupture.

Case.—**Rupture of spleen by slight blow.**—Nabu Sheikh, Musalman male, 40, of Diwanganj, 14th November, 1886, said to have been killed by a stab. A small wound, $\frac{3}{4}$ inch long, gaping $\frac{1}{2}$ inch wide over eighth left rib, about five inches above and external to the umbilicus. From its outer end a slight scratch runs upwards and outwards for three inches. This wound was quite superficial, $\frac{1}{8}$ inch deep, penetrating only into and not through the subcutaneous cellular tissue. Peritoneum healthy, contained about half a pint of dark fluid blood round spleen. Stomach healthy, empty. Liver enlarged and congested. Spleen enlarged, about twice normal size; a rupture three inches long, crossing outer side halfway between upper and lower ends. Death was due to rupture of the spleen, probably caused by the blow, trifling in itself, which inflicted the wound over eighth rib.—Dr. D. G. Crawford, *Ind. Med. Gaz.*, 1902, p. 215.

Case.—**Rupture of Spleen by Artificial Respiration.**—Professor Powell reports an autopsy in a case where the spleen was ruptured by a medical man in performing artificial respiration for opium-poisoning.

It may occur without any external marks of violence being present—this was so in about one-third of Harvey's cases—but

in about one-fifth of these the tissues under the skin over the region of the spleen, on dissection, showed signs of bruising. Rupture, even of an apparently healthy spleen, may be unaccompanied by external marks of violence, but in such cases the subcutaneous tissues will probably (but not certainly) show signs of bruising.

Site of the rupture—this is generally on the inner surface.

Period of survival after rupture.—Death may occur in a few minutes or not for several days. Chevers mentions one case of survival for five days and another of death on the eighteenth day from pleurisy and pericarditis. Considerable power of locomotion may remain after receipt of the injury. Dr. E. G. Russell, I.M.S., gives two[1] cases in which recovery apparently took place after rupture or bruise of the spleen; the diagnosis, in one case, being confirmed by dissection of the victim, who died several years afterwards. He also quotes four cases in which the victim survived the injury for over twenty-four hours; in one case five, in two four, and in one two and a half days. Dr. Powell relates a case of a European lady, aged 60, who was knocked down by a cart, drove to hospital in a springless cart and lived eight days. Her spleen was found ruptured at the *post mortem*.

Cases.—(*a*) Dakka, Hindu male, 31, said to have been beaten on 2nd January, 1888, and to have died "a few days later." *Post mortem* on 7th January, 1888. Peritoneum contained a pint of fluid effused blood; large omentum bruised, small gut bruised in many places; stomach empty; spleen much enlarged, ruptured at upper part of external surface.

(*b*) Mymensingh, Musalman male, ten, said to have died three days after being knocked down. No external marks or injury. Peritoneum healthy; stomach healthy, contained a little muddy fluid; spleen slightly enlarged, a small rupture $\frac{3}{4}$ inch long at lower end of anterior border, ʒ ii–ʒ iii of blood effused around the rupture.

(*c*) 24-Parganas, Musalman male, fifteen, said to have been beaten with *lathis* on 20th July, 1897, was admitted to the Campbell Hospital on the same day, and died there on the 6th of August; *post mortem* on 7th August. There was an oblique longitudinal mark, five inches long, across the left side of the back, with fracture of four ribs, the eighth to eleventh left ribs. The left temporal and parietal bones, and the left wing of the sphenoid bone, were fractured, liver pale, waxy, bloodless; spleen much enlarged, weight 1 lb., a rupture, $\frac{3}{4}$ inch long, on inner aspect; left kidney weighed 6 ozs., a rupture in it, $\frac{1}{4}$ inch long. There can be no doubt about the facts of this case, as the boy was in hospital from the day of the injury till his death. He had undergone fracture of three of the bones of the skull, four ribs, and rupture of two viscera. Yet he survived for no less than seventeen days; and, in the end, the immediate cause of his death appears to have been inflammation of the meninges of the brain.—*I. M. G.*, 1902, p. 219.

[1] *Malaria, its causes and effect*, 1880, pp. 217–221.

Wounds of the spleen are rarer than rupture.—In Dr. Crawford's series there was only one case to every fifty of rupture. Death has in several cases resulted through hæmorrhage from exploration of the spleen with a hypodermic needle in cases suspected to be malaria or Kala Azar.

(*a*) Dakka, 2nd January, 1872; Musalman male, age not noted, said to have been killed with a needle. Marks of puncture in left hypochondrium. Abdominal cavity contained a great quantity of fluid blood, and a clot weighing 1 lb. 15 oz. Spleen weighed 3 lb. 15 oz., and on its outer surface were punctures corresponding with those in abdominal wall, made by a sharp instrument. The examination was made by Dr. J. N. B. Wise, an authority on native customs, who made the following remarks:—"Death due to hæmorrhage from puncture of spleen. It is customary for *kabirajes*, under certain circumstances, to plunge iron needles into the spleen, when enlarged. This case was an unfortunate selection, as the organ was soft and vascular."

(*b*) Dakka, 14th November, 1880; Hindu female, 45, said to have died of wounds. A wound between scapulæ, six inches long, one broad, one deep. A second wound between tenth and eleventh ribs on left side, six inches long, 1½ broad, penetrating abdominal cavity. Peritoneum contained 4 or 5 coagula; stomach protruded through wound, contained half-digested rice and *dāl*. Spleen escaped through wound, completely divided in two parts transversely.

Liver.—Rupture of the liver is usually the result of extreme violence accidentally applied, such as buffer accidents, or when body is run over by a motor car. There is reason to suppose that in very exceptional cases recovery may take place after a slight rupture of this viscus, and also that in very exceptional cases rupture of the liver may occur during life, without application of external violence. Non-accidental rupture of the liver may be caused without a weapon. Harvey, for example, mentions a case where it was ruptured by a kick, and two others in which the rupture was caused by kneading with the knees and elbows, or '*kīl kanī*.'

Rupture of the liver may occur from violence inflicted during life, without any external marks of injury being left. In about one-fifth of the Bengal cases no external marks of injury were present. Considerable power of locomotion may remain after receipt of the injury. Taylor remarks, that unless the large veins at the back of the liver are injured, bleeding from a ruptured liver may occur only slowly, and the patient survive some time; but thereafter die rapidly from sudden copious effusion of blood, caused by muscular exertion, or fresh violence. The same author mentions one case of survival for eight days, and two of survival for ten days, after rupture of the liver.

In 33 cases Dr. Coull Mackenzie found the *cause* to be:—14 cases by being knocked down by runaway horses in or outside carriages and by

bullock carts; 8 resulted from falls into the holds of ships and boats; 2 resulted from falls on piles of bricks; 1 was a man knocked down while helping to remove a boiler—the boiler rolled on his back and crushed him to death; 1 was that of a man struck by a tub full of salt, which was being removed from a ship's hold; 1 a porter, who, while carrying a heavy box on his head, slipped and fell on his back with the box on the front of his chest and abdomen; 1 was a man, who, while working on board a ship, was struck by a sling containing three 2-maund bags of *dab;* 1, a drunken man, fell heavily on a hard metal rod; 1, a sais kicked over the abdomen by a horse he was grooming; 1, a lad in a fishing boat which collided with a pontoon of the Hughli Bridge, was precipitated into the river, and either was driven by the current against the pontoon, or its mooring chains a few yards below; 1 was a man struck by the handle of a winch in motion.

Death was reported to have occurred instantaneously in 11, or 32·3 per cent., within an hour; in 4, or 11·7 per cent., in from one to two hours; in 1, or 2·9 per cent., from two to three hours; in 4, or 11·7 per cent., in three to seven hours; in 1, or 2·9 per cent., in three days; and in 7, or 20·5 per cent., the time was not mentioned by the police authorities.

Case.—**Motor-car Rupture of Liver.**—Prof. Powell reports: "A Pardesi, aged 22, ran against a motor-car on the 26th July, 1915, the front axle passing over his abdomen. He died eight days later when I found rupture of the liver.

"In 1902 a clerk was seen to walk about twenty yards and then lie down on a bench in Colaba Railway Station. He shortly after died. *Post mortem* I found the liver crushed into several pieces; one piece nearly as large as a tennis ball lying free in the abdominal cavity. No doubt he was caught between the buffers of some trucks that were being shunted at the time.

"I did not credit the statements of several eye-witnesses who said he had walked unaided to the bench, but subsequent experience of many cases of rupture of the liver in motor-car and other accidents has now convinced me that the statements of the eye-witnesses were quite credible."

Case.—**Homicidal rupture of liver.**—In 1880 a drunken native in an altercation pushed another, Suk Chand Karmokar, who fell heavily to the ground and died "very shortly after." *Post mortem* examination showed no marks of injury on abdomen or thorax, but a rent in right lobe of liver five inches long. Liver was hard and not enlarged. Prisoner was tried for culpable homicide not amounting to murder.—Dr. Coull Mackenzie, *Ind. Med. Gaz.*, 1889, p. 229.

The gall bladder may be ruptured by violence, as in a case mentioned by Harvey, in which the subject was a boy *æt.* five, who had been strangled, and in which the rupture was probably caused by pressure with the knees. Ogston, however, remarks that "ruptures of the gall bladder proper have usually been the result of emetics given to ensure the expulsion of gall stones."

Intestines.—Rupture of the intestines is usually fatal, the cause of death being commonly peritonitis, the result of extravasation of their contents. Rupture may occur solely from

disease, or from violence acting on a diseased portion of the intestine, or solely from violence. Hence, when this injury is found, careful examination of the ruptured portion for signs of disease, *e.g.* ulceration or softening, is of special importance.

The position of the rupture was the upper jejunum in four cases, the lower in two, the middle in one, the ileum and the sigmoid flexure in one, in Dr. Mackenzie's cases.

Rupture even of a healthy portion of the intestines may occur from a comparatively slight amount of violence. The violence causing the rupture may leave no external marks. Out of twenty-five Bengal cases, in twelve external marks were absent; but in five of these, on dissection, signs of bruising were found in the subcutaneous tissues. Rupture of the intestines may be the result of accidental or non-accidental violence, seven of Harvey's cases apparently were accidental. Ten out of Mackenzie's eleven were accidental, due to horse-kicks, blows, or crushing. When non-accidental, the injury is often the result of a blow without a weapon. Usually, after the receipt of the injury, the sufferer is capable of considerable muscular exertion. For injuries to the Rectum, see p. 139.

In Dr. Mackenzie's fatal cases, 1 died in 7 hours, 1 in 12 hours, 2 in 24, 1 in 29, 2 in 30, 1 in 58 hours, 1 in 3 days, and 1 each in 5 and 8 days. The cause of death was peritonitis in 9 out of the 11 cases, and shock in the 2 others.

Case.—**Rupture of intestine.**—In 1883, Newal Kissori Chaube, in a dispute with a Chinese shoemaker Aghain in Calcutta about the price of shoes, in which the Chinaman struck Newal with a bamboo, and another Chinaman kicked him in the abdomen. The injured man refused to stay in a hospital and went to his house, where he died about five days after the assault. The *post mortem* examination showed the organs generally to be healthy, but there was a circular rupture of the size of a threepenny piece in the lower third of the jejunum, around which lymph was extravasated. The abdomen contained 72 ounces of fæcal-smelling brown fluid, and there was acute peritonitis. Death was reported due to peritonitis following rupture of intestine. The two Chinamen were tried on two counts—culpable homicide not amounting to murder, and doing a rash and negligent act, but were acquitted by the jury on both charges.—Dr. C. Mackenzie, *Ind. Med. Gaz.*, 1890, p. 70.

Case.—**Gunshot blow** of intestine without wound.—Dr. A. Powell reports a case of an officer struck at Sanna's Post in 1900, on the anterior abdominal wall by what he thought was a Mauser bullet. There was only slight bruising and abrasion of skin. A few days later obstruction set in. Abdomen opened showed several inches of the gut gangrenous.

Stomach.—This viscus is liable to rupture from disease. Cases also are recorded of rupture from over-distention and violent ineffectual efforts to vomit, and of spontaneous rupture without any very apparent cause. Taylor mentions a case in which rupture both of the stomach and the

spleen occurred from a fall of about twenty feet, and in which no bruises or other external signs of injury were present. In one of Harvey's cases, also, although there was a fracture of the skull, and bruises on various parts of the body, the result of *lathi* blows, no external sign of injury could be found over the region of the stomach, although this viscus was ruptured. It is possible, therefore, that rupture of the stomach from accidental or non-accidental violence may occur, and no external signs of injury be present.

Pancreas.—Injury to this viscus from external violence is very rare. McLeod and Harvey, however, each mentions a case; in the first the viscus was ruptured, but no external marks of injury were present; in the second the viscus was "injured," and contusions, not visible externally, were present on both sides of the spine. In both, the injury appears to have been caused by kicks or trampling with the feet.

Kidneys.—Rupture of the kidney solely from disease is extremely rare. Disease or abnormal formation of this viscus may, however, conduce to rupture from violence. Rupture of the kidney usually occurs only from great violence, and hence is often accompanied by other lesions. Notwithstanding this, in nearly one-half of the cases, signs of external violence over the region of the kidneys were absent. In sixteen of Harvey's cases, the nature of the violence causing the rupture was stated. This was in eight, blows from blunt weapons; in two, kicks; in one, trampling; and five resulted from falls from a height. Two accidental cases are reported by Dr. Mackenzie (*Ind. Med. Gaz.*, 1890, p. 205). One, a man, lived 38 hours and died of shock; the other, a girl, died within half an hour, of hæmorrhage. Taylor mentions a case in which a man walked some distance after an accident whereby one kidney was torn completely across, death occurring suddenly, within six hours after receipt of the injury.

Bladder.—In rare cases, rupture of the bladder occurs solely from disease, either of the bladder itself or disease, *e.g.* paralysis or stricture, leading to over-distention. In the great majority of cases, however, the cause of the rupture is violence applied directly to the region of the distended organ. Often in cases of rupture from violence, no external marks of injury are to be found. The injury is usually fatal, either from shock, or peritonitis due to extravasation of urine; recovery, however, sometimes takes place. The violence leading to the rupture may be accidental, *e.g.* a fall from a height, or a fall on some projecting object, or a crush, or non-accidental, *e.g.* a kick in the pubic region. In females, rupture of the bladder sometimes occurs from pressure of the child's head on the urethra, causing over-distention during delivery.

Uterus.—Rupture of the unimpregnated uterus is only likely to occur from very great violence. Rupture of the pregnant uterus may occur independently of violence, as an accident during delivery, and, in rare cases, may be partial only, affecting the peritoneal coat and muscular tissue, but not extending into the cavity. Rupture of the pregnant uterus may occur from external violence without any external marks of injury being present. The uterus often apparently escapes injury, even when great violence is applied to the abdominal wall in attempts to cause miscarriage (see cases 'Abortion'). Harvey, however, mentions a case in which extensive bruising—not rupture—of the uterus, caused in this way, resulted in death; in this case also, no external marks of violence were present. The uterus may be wounded per vaginam, in an attempt to cause miscarriage. Injury to the uterus per vaginam also sometimes

results from thrusting sticks, etc., into the vagina after rape, or in revenge for infidelity. Rupture of an ovary, or fallopian tube, may be found: this, it must be remembered, may occur as a result of ovarian or tubal pregnancy, and hence blood-clots, etc., found in the abdominal cavity should in such cases be carefully searched for an embryo.

Large abdominal blood-vessels.—Harvey mentions three cases of rupture of the inferior vena cava from extreme violence. In one—caused by the sufferer being jammed between two boats—bruising of the mesentery was the only other serious injury present. In another—the result of a fall from a high tree—the skull was also fractured; and in the third, the liver was ruptured. The same author also mentions a case of probable rupture of the splenic vein.

External genitals.—(*a*) *The male genitals.*—Severe contusions may cause death, or severe compression of the testicles may prove fatal from shock.

Seizing by the testicles is a common method of assault in India, and Chevers mentions a case in which a man dragged another along in this way with such violence "that the whole preputial integument was torn away." Incised wounds may be attended with severe and even fatal hæmorrhage, or by extravasation of urine, ultimately terminating fatally. Incised wounds, amputation of the penis, even removing the whole of the external genitals, are sometimes self-inflicted; generally, however, in such cases the individual is insane, but individuals apparently perfectly sane may mutilate themselves by cutting off a portion of the penis. In India, removal of the male genital organs used formerly to be largely practised, in order to manufacture eunuchs for immoral purposes. Young boys were generally selected, and a clean sweep made of the whole of the organs. Chevers, on the authority of Dr. Elden, appears to consider that, in 1870, this practice still existed extensively in the Rajputana States, and Harvey (1871–72) mentions the case of "a Chamar boy, aged eight, at Banisal, whose genitals were completely cut away, probably to fit him for the duties of a eunuch." Cases of this kind excluded, incised wounds of the male genitals inflicted by another, indicate, as a rule, a sexual motive. Occasionally the person inflicting the injury is a female, as in a case cited by Harvey, of a woman at Kachar, who "seized a weapon and inflicted a deep and severe wound on the penis of her father-in-law, who wished to take liberties with her." He also mentions an exceptional case, in which a eunuch possessed of a penis had it shaved off by some of his fellow-eunuchs, apparently from motives of jealousy.

Case.—A 'playful' **kick** on a boy's perineum is reported by Dr. A. Powell to have caused death by rupture of urethra with extravasation of urine.

Case.—**Branding of Vulva.**—Prof. Powell reports having seen three cases of branding of vulva with a red-hot *dhao* or knife, as punishment for suspected infidelity, and one case as a prophylactic on the Crusader's principle of the iron-drawers.

(*b*) *The female genitals.*—Incised, or even contused wounds of these may prove fatal from loss of blood. Some years ago, several cases occurred in Scotland of murder by wounding the female genitals. In one of these, death occurred in ten minutes; and in another, a wound of the labium three-quarters of an inch long and three inches deep, proved rapidly fatal from loss of blood. A kick on the vulva—like a blow on the

head—may cause an apparently incised wound, and prove fatal from hæmorrhage (see *Case* below).

Fatal hæmorrhage may, however, occur without external violence, from spontaneous rupture of a large vein in one of the labia, as in a case referred to by Ogston.[1] Wounds of the female genitals are sometimes the result of an accidental fall on some projecting sharp or pointed object. In India, cases of injury by thrusting a stick into the vagina are not uncommon. Harvey states that twenty-five such cases, ten of them fatal, were included in the Bengal, etc., returns for 1870–72. Sometimes such injuries are inflicted after rape has been committed. Similar injuries are sometimes produced in attempts to procure abortion.

Case.—**Death from a kick on the vulva.**—A woman, *æt.* thirty-six, while in a stooping posture, was kicked by her husband in the lower part of the abdomen, and died in about an hour from loss of blood. There was no injury to the vagina or uterus. There was a wound about 1 inch long and ½ inch deep, situated at the edge of the vulva, extending from the pubes along the ramus. The left crus clitoridis was crushed throughout its length, and from this the fatal hæmorrhage had taken place.—Taylor, *Med. Jur.*, I. 678.

Rectum.—Thrusting a stick or other similar object into the anus is a mode of torture or murder occasionally resorted to in India, and the threat to do this is a very common form of abuse. Injuries produced in this way may cause death. Fifteen cases—eleven of them fatal—of the infliction of this form of violence were included in the three years' returns for Bengal, etc., reported on by Harvey. Very often other injuries accompany this form of violence. An individual, for example, is attacked and violently beaten by several others, and finally thrown down and subjected to it. In the majority of such assaults, the victim is a male, and the motive leading to the infliction of the injuries appears to be most commonly punishment for adultery or theft. Possibly, also, in some cases, the injury is connected with sodomy, in the same way as similar injuries to the vagina are sometimes connected with rape. Chevers mentions a case, in which several children, of about eight or nine years old, threw down a boy, one of their number, and killed him by thrusting a small stick into his rectum; and Harvey mentions a similar case, said to have been accidental. But it is to be remembered that dilatation of the rectum, and protrusion of the gut, is a common effect of putrefaction, and hence that such a condition does not necessarily indicate the infliction of this form of injury. Injuries to the rectum and anus are sometimes the result of an act of sodomy (see ' Sodomy ').

Extremities.—Injuries to the extremities vary greatly in gravity, according to their situation and extent. Death may result if a large vessel is wounded, directly from loss of blood, or, if the injury is severe, from shock; and slight injuries may contribute to the production of fatal shock in cases where this results from numerous slight injuries. Again, injuries to the extremities may prove indirectly fatal from inflammation and exhaustion, or from supervention of disease; or, if the large vessels or nerves are divided, may necessitate amputation, followed by similar consequences. Injuries to the extremities necessitating amputation, or permanently impairing their power, of course amount to grievous hurt. Obviously, injuries to the extremities may be accidental, or self-inflicted. No further remarks are called for here in regard to

[1] *Lect. Med. Jur.*, p. 486.

these. As regards injuries inflicted by another, it may be pointed out that very severe injuries of the extremities may be produced without a weapon. Violent twisting of a limb, for example, may cause dislocation of a joint. Again, comparatively slight injuries to the extremities, especially when caused by ropes or cords, may indicate the infliction of very severe **torture.** The nature of the torture thus indicated may be: torture by compression, as when the fingers are tied together and wedges driven in between them, or torture by binding the body or limbs in a constrained position, or torture by suspension. A recognized torture by police to extract confession is to thrust thorns into the quicks of the finger-nails and toe-nails. Harvey mentions a case which shows that suspension head downwards may cause death from congestion of the brain. Cases in which the right hand is completely severed from the body are tolerably often met with in India. This, especially if accompanied by mutilating wounds of the ears or nose, usually indicates punishment for adultery or for theft, as the motive leading to the infliction of the injury.

In the cases of torture by *Bans-dola* (see also p. 128), or crushing by bamboos being forcibly rolled over the chest, there may be, if the body is fresh, no external marks of injury, yet the ribs may be broken and the lungs lacerated.

CHAPTER V.

HOMICIDAL WOUNDS v. SUICIDAL OR SELF-INFLICTED.

"*For murder, though it hath no tongue, will speak.*"

Is the wound '*accidental*,' '*self-inflicted*,' including '*suicidal*,' or inflicted by another, '*homicidal*'? The importance of this question is obvious. In considering it we must remember that in India severe, even mortal, injuries are sometimes inflicted on an individual **with his consent**, by another or others, for the purpose of supporting a false charge.

Case.—**Wounds inflicted by consent** in support of false charges.—Chevers (*Med. Jur.*, p. 358) states on the authority of Mr. Perceval that at one time two or three gangs existed in Bombay who cut and wounded each other for the purposes of extortion. "They used to cut one another's necks and arms by turns as the lot fell, and accuse some rich passer-by of having done it. . . . It fell to the lot of a youthful member of one of these gangs to have his neck cut. The person appointed to cut him was a drunken barber, who, instead of making a slight cut, inflicted a mortal wound. The gang fled, abandoning the youth, whose dying confession led to their arrest."

Case.—In a case before the High Court, Bombay (the Ahmedabad Conspiracy Case), the evidence showed that certain individuals, A B and others, wishing to injure C D and others, proceeded as follows:—They hired two men to wound a third, E, instructing E, after receiving the injury, to first of all accuse them (A B and others) of the assault, and then to make a pretended confession that this was a false charge brought at the instigation of C D and others. This programme was carried out, E very nearly dying, owing to the severity of the wounds inflicted on him, and C D and others were convicted of instigating E to bring a false charge against A B and others. After C D and others had suffered a considerable portion of their sentence of imprisonment the truth was discovered. A and B having brought a civil action for damages for malicious prosecution against C D and others, who were then in gaol, it appeared on the civil trial that A B and others had been instigated by an individual who had kept himself in the background, but was the real mover in the whole plot. A and B, having succeeded in convicting C and D, had caused an attorney's letter to be written to this individual demanding payment of the promised reward! And it was principally by proof of this fact that the real truth came out.

Case.—**Murder to support a false charge.**—*Reg.* v. *Muhammad Amanji and Husan Amanji* (Bo. H. C. Rep., Vol. VIII., 1871, p. 110).—A summary of the main facts in this case and two others connected with it (*Reg.* v. *Muhammad Valli* and *Reg.* v. *Alibhai Mitha*) is as follows:—It appeared that two factions existed in the village of Karmar in the Broach Collectorate—A and B. Alibhai Mitha and Muhammad Amanji were members of faction A, and Muhammad Valli was a member of faction B. The two factions had a scuffle, in which one of the members of faction B got a blow on the head, and was taken into Broach. On this, faction A held a consultation, at which it was determined to break or bruise the head of one of their own party (Alibhai Mitha's old mother), and take her into Broach as a sort of makeweight against the broken head on the side of faction B. This was done apparently with the consent of the sufferer, and a false charge laid against faction B. While Alibhai's mother was in hospital, Alibhai's faction (faction A) held another consultation, the result of which was that they determined to poison Alibhai's mother in order to have a death on their side instead of simply a broken head. Accordingly they put arsenic into some food, gave it to the old woman, who thereupon was attacked by violent vomiting, which it was stated brought on rupture of the spleen, from which she died. On this Muhammad Valli (a member of faction B) brought his sister out of his father's house and killed her by striking her on the head with an axe. She was heard just before she was struck to say, "Why do you kill me for other people?" Muhammad Valli then dashed his own head violently against a wall—all this appears to have taken place in presence of the girl's father and other witnesses—and a false charge of murder and assault was then laid against faction A. Next Muhammad Amanji, a member of faction A, expressed his intention of killing himself as a set-off against the girl's death. On this his old mother begged that she might be killed instead. Thereupon Muhammad Amanji and his mother went into the backyard of their house, and shortly afterwards the former rushed out, with a wound on his chest, calling for the police *patel* to come and take the deposition of his wounded mother. This was done, and the mother taken into Broach to the hospital. There her wounds were considered slight, and fifteen days after her admission she was discharged, and went back to her village. About six days afterwards her corpse was brought back to hospital. The civil surgeon certified that "these wounds did not bring about the death of this woman; she died of old age." This, however, the court appeared to doubt. In giving judgment, Gibbs, J., remarked: "The evidence shows . . . that there are two factions in this village, and that murders have been committed on each side—not, as would be naturally expected, by members of one faction on a member of the other, but by members of one faction on a helpless female of their own, so as to throw either the guilt of blood or the blame of the crime on the other party. Such a state of things is hardly credible, but this is an instance of truth being stranger than fiction."

Homicide.

Homicide, or the murder of a human being, is the most serious of all crimes, and it is punished as such under British law in India, where life tends to be held rather cheaply.

Causes of homicide in India.—The causes which lead a man in India to commit murder are often trivial in themselves.

They usually originate in quarrels about land and women, or in robbery and malice.

1. **Connected with sexual relations.**—Under this head may be noticed as more or less common in India (*a*) Murder of *husband by the wife:* here the motive is usually either revenge for ill-treatment or the facilitation of an intrigue, and very frequently poison—often in the latter class of cases supplied by the paramour—is the means resorted to; though in some cases the poison is given as an aphrodisiac or love-philter, and not with homicidal intent. (*b*) Murder by way of punishment for *adultery:* here mutilation of the body of the victim often accompanies the murder: mutilation of the nose, ears, lips, etc., is a not uncommon method of punishing a woman for sexual infidelity. (*c*) Murder of women pregnant from *illicit intercourse:* in such cases the victim is frequently a Hindu widow (a victim of the custom which prevents the remarriage of child-widows), and very often the fatal result is a consequence of injuries inflicted for the purpose of procuring criminal **abortion** (*q.v.*). (*d*) **Infanticide** (*q.v.*), also frequently the result of the Hindu restriction on child-widows. (*e*) Murder of females after violation, or **rape** (*q.v.*): the victim being in some instances a young girl, in others an adult female. Young children (omitting Hun cases in war) are raped first, and murdered afterwards, to destroy evidence. Adults are first murdered to overcome resistance and then raped, as a rule.

2. **Connected with acquisition of property.**—More or less common examples of this are: (*a*) Homicide arising out of disputes in regard to the possession of land. Often such disputes lead to affrays, in which clubs and other blunt weapons are freely used with fatal results. (*b*) Death from injuries inflicted by a gang of robbers or *dacoits*,[1] the injury being sometimes inflicted by way of torture, often by burning, in order to extort information as to the place in which money or valuables have been hidden. (*c*) Murder of young children for the sake of the ornaments worn by them. This is a variety of homicide of tolerably frequent occurrence in India. (*d*) '*Thuggi*' or highway robbery accompanied by homicide. The description of murder used formerly to be often met with in India, strangulation being the means commonly employed. Thuggi, however,

[1] "Where five or more persons conjointly commit, or attempt to commit, a robbery, or where the whole number of persons conjointly committing, or attempting to commit, a robbery, and persons present and aiding such commission or attempt amount to five or more, every person so committing, attempting, or aiding, is said to commit *dacoity*."—*I. P. C.*, *s.* 391.

is now rare, and in such cases as now occur, the death of the victim is usually the result of drugging, datura being the agent commonly used. (*e*) Murder by way of punishment for theft is not infrequently met with in India in which thieves caught in the act are set upon and violently beaten, perhaps killed.

3. **Sacrificial.**—Human sacrifice as a religious rite, several cases of which are mentioned by Chevers, formerly widely prevailed in India, but has now been largely suppressed, though it has been on the increase in India in the past few years (1917). The same may be said of the practice of '*sati*,' or widow burning, before alluded to, and of the practice of burying widows alive in their husbands' graves, formerly prevalent among certain castes. Cases of homicide connected with superstition still, however, occasionally occur in India, *e.g.* the killing of individuals suspected of witchcraft, and cases in which death results from the subjection of the victim to an ordeal for the discovery of theft (see *case*, p. 31), or of supposed practice of witchcraft (see 'Drowning,' Chap. VI.). A case of a father sacrificing his son occurred in Bombay in 1901, and another in 1916.

4. **Murder of infants.**—The peculiar features and modes of detecting this crime in India are described under 'Infanticide,' Chap. XII.

The **Victims** of criminal homicide are often unoffending persons. Murder cases often occur in India in which the victims are numerous, and include children or others who have given the murderer no offence. In cases of arsenical poisoning, for example, the victims are often several in number, some being children; and often in such cases the injury to avenge which the murder is committed is of a very trifling character. Again, in 'running *amok*' cases, it frequently happens that some or all of the victims are unoffending persons. Cases also are sometimes met with in India in which an individual, in order to revenge himself on an enemy, kills some unoffending person, sometimes a relation or friend, solely for the purpose of bringing a false charge of murder against the person who has injured him.

Homicide with consent of victim. In India it sometimes happens in a case of homicide that the individual killed has consented to suffer death. Thus, for example, in the cases of homicide for accusation just referred to, the victim is sometimes

a consenting party to the crime. The custom of the burying alive—'*samadh*'—of lepers, which formerly was widely prevalent in India, affords another example of this description of homicide, as, at any rate in the great majority of cases, the sufferer used to be a consenting party.

Suicide.

Suicide, or 'self-murder,' is regarded by the law as murder, a murder committed by a man on himself; and the distinctions between murder and manslaughter apply also to this. So fully is suicide held to be murder, that every one who aids or abets suicide is guilty of murder.[1] It is in law the same as *felo-de-se* or felony committed on one's self. The expression usually added to the verdict of suicide, namely, 'whilst temporarily insane,' is a legal contradiction, for an insane is held to be incapable of murder, or indeed any criminal act, either upon himself or another.[2] This expression is regarded as a charitable addition to relieve the suicide and his family from the stigma and other penalties of the crime, and for recovering the monies of life assurance.

Curiously enough, although suicide is self-murder, yet an 'attempt to commit' suicide is *not* an attempt to commit murder, but a common misdemeanour (*Regina* v. *Doddy*, 6 Cox C. C. 463).

Causation of Suicide and Suicidal Mania.

It is generally considered that every person who commits or attempts to commit suicide must be insane, at least, momentarily, when they have reached that complexity of mind in attempting to slay himself or herself; but by far the great majority of suicides occur in those who kill themselves without having shown signs of insanity, or such marked signs as would have warranted their restraint by law. Suicidal propensities occur in all forms of insanity, in maniacal, melancholic, and also monomaniacal; but although the onset of suicidal tendencies is readily noticed in insane patients of asylums and precautions are taken accordingly, in civil life these premonitory signs usually pass more or less unnoticed.

What are the incentives to suicide?—The most practical answer to this question that we know of is given by Dr. Wynn

[1] Sir Jas. F. Stephen, *Hist. of Crim. Law*, 1883, III., 104.
[2] R. H. Wellington, *Trans. Med. Leg. Soc.*, 1903, I., 82.

Westcott, and although his experience lay in London it nevertheless helps us to understand the inner causes of Indian suicide. He says[1] the conditions of life which make life unbearable to the suicide "are very various, seldom single, and often complex. The sufferers from misfortune, passions, disappointments, fear, and pain, although not insane in a legal sense, do essentially differ from those neighbours who do consent to live from day to day under mental or bodily suffering until released by the return of peace and happiness, or by a natural death. It is not possible to define the difference between these two types of person, but the essential difference does exist, and has been the subject of great controversy"; some believing it to be the difference between the pessimist and the optimist, the true believer and the unbeliever, the coward and the brave man. "Some doctors say," continues Dr. Westcott, "that the distinction is based on heredity, or, at any rate, that an instability of character is founded on an imperfect or faulty material basis in the brain and nervous system . . . nor can the characteristic tendencies of the defective state be recognized by symptoms, unless the blot upon the brain be so deep as insanity."

The **proximate causes** of suicide, in Dr. Westcott's long practical study of the subject in London, appear to be seldom solitary. "*In the majority of cases we have found that the sufferer has tolerated much discomfort, pain, or sin, for a long period, and then has succumbed to an added grievance, or to the onset of an overmastering passion.* So that we are able to refer to the basic absence of sufficient *vis vitæ* or the determination to survive; and in addition, to a secondary cause, such as alcoholism, bodily disease, or poverty; and then to a final cause, such as a fit of passion, an attack of pain, or a disappointment in love. In ordinary cases of suicide it is not practicable to obtain sufficient details of life-history to decide on secondary and final causes with accuracy," only approximately.

Direct causes of suicide.—In England, according to Dr. Westcott, "next to *alcoholic excess* (with its loss of occupation, money troubles, family quarrels and *debauchery*) the most fertile cause of suicide is *disease*. The violent pain of acute disease and the prolonged sufferings of chronic disease alike lead to the suicide's grave; incurable diseases are even more commonly found to lead to suicide than such as are very painful. My statistics show that *ten per cent. of suicides are due to illness*, viz. paralysis, influenza, cancer, urethral stricture, prostate, piles, locomotor ataxy, neuralgia, and the angina of cardiac disease; insomnia is a common cause. Hard work and overstrain, worry of business, loss of reputation,

[1] "On Suicide," *Trans. Med. Leg. Soc.*, II. pp. 87, etc.

family and unfortunate love affairs, and everything that lessens human prosperity affects the mind prejudicially and encourages self-destruction." [1] In France, out of 5922 suicides,[2] $\frac{1}{4}$ were alleged to be due to mental disorder, $\frac{1}{6}$ to domestic troubles, $\frac{1}{5}$ to alcoholism, $\frac{1}{7}$ to poverty and misery, $\frac{1}{7}$ to pain and remorse, $\frac{1}{20}$ to unrestrained passions, $\frac{1}{20}$ to remorse and fear of retribution, and $\frac{1}{30}$ were unclassed.

Causes in India of suicide.—Like the Romans, the Indians approve of suicide under certain conditions—the Greeks did not, and it is curious that the Greek view should agree with the Christian practice in abhorring suicide.

Pythagoras and Socrates took the sentry view of life: the sentry duty might be bitter and laborious, but man has been placed on guard by one of his superior officers—the gods, and was guilty of desertion if he voluntarily quitted his post. On the other hand, the Roman Epicureans held that if life became no longer enjoyable death was the wiser alternative. The Stoics based their approval of suicide on severer and nobler grounds. "How," argued they, "could a man live according to right reason if his body was distempered by disease, his reason decayed or doting, his better will coerced by a political tyranny . . . perhaps crushed by cruel tortures? To these evils the 'ushering of oneself out of life' was a welcome deliverance." Whilst the early Christian view was that pain and sorrow are disciplinary benefits, instead of evils, and that self-destruction since the Council of Arles in 452 A.D. was branded as impious and a felony, so that the body of the suicide was denied burial in consecrated ground, and his property was confiscated.

In modern times, however, amongst civilized nations, there is a tendency to halt between these two extremes, in that whilst discouraging self-destruction, practically no legal penalties are attached to suicide or attempted suicide in Europe or America, although abetment of suicide is held to be equivalent to murder in England. In India an attempt at suicide is an 'offence.'

For India the following causes of suicide deserve special mention, from their frequency, or peculiar character, and it should be noticed that most of these are also alleged causes of insanity.

Domestic troubles and worries.—The mental distress arising out of quarrels with their husbands, or husbands' relatives, often of a trifling character, is a common cause of the suicide of wives in India; and similar domestic differences are also a not uncommon cause of the self-destruction of the husband.

Remorse and shame.—This is not an infrequent cause of self-murder amongst Hindu women as a result of illegitimate

[1] "On Suicide," *Trans. Med. Leg. Soc.*, II. p. 91.

[2] Analyzed by J. F. Kolb in his *The Condition of the Natives*, quoted by Westcott, *ibid.*, p. 88.

relations consequent on the custom of enforced child widowhood (see cases in Chaps. XIII. and XIV.); and it also operates in cases of unrestrained passion, jealousy, and indulgence in debauchery, and fear of arrest on criminal charges.

Venereal Disease is a frequent cause of suicide. So much so is this, that Professor Powell states, "In otherwise inexplicable cases of suicide I instinctively examine the penis, venereal disease being a common cause of suicide, sometimes from syphilophobia, more often in cases of persons engaged to be married, or in married men whose wives are expected back from home or the 'Hills' after a prolonged absence."

Fanatic, religious, and imitative.—Self-destruction from religious motives was formerly of somewhat frequent occurrence in India. One variety of this form of suicide consisted in the individual offering himself as sacrifice, in order to propitiate one of the Hindu deities, as, for example, by casting himself under the wheels of the car of Jaggarnath, or drowning himself in the Ganges. No doubt, also, in some cases of '*sati*,' or burning of widows on the funeral pile of their husbands, formerly of frequent occurrence in India, the victim was a consenting party, willingly or unwillingly. Several forms of religious suicide have been detailed on pp. 30, 32.

Suicide by **children** is not uncommon in India. Out of 1716 suicides in Bengal 23 were children, and out of 4172 in Oudh 46 were children. The **means** by which suicide is usually committed has already been detailed.

. The verdict "suicide while in a state of temporary insanity," so frequently returned by coroners' juries in England, is most probably in many cases the result of the fact that, by the law of England, self-destruction (in a person of sound mind) is a felony (*felo-de-se*) or murder entailing forfeiture of goods and burial in unconsecrated ground, unless the suicide be declared to be of unsound mind, and the average English jury shrinks from calling the suicide a criminal. The law of India, however, contains no provision making the actual commission of suicide an offence, although an attempt to commit it is so (see 'Wounds'). Section 30 of the Coroner's Act (IV. of 1871) expressly declares that it shall no longer be the duty of coroners in India to inquire whether any person dying by his own hand was or was not *felo-de-se*, and further that a *felo-de-se* shall not forfeit his goods.

Frequency.—In England, suicide, which forms about one-tenth of the reported violent deaths, is over 100 per million of population, and is, as in all civilized countries, steadily increasing, the rate having progressively increased from 66 per million in 1861 to 105 in 1903.

London itself has a rate of only about 90 per million living persons, and has always had a smaller rate than foreign cities, which have been estimated to have the following suicide rate per million living:—Paris, 400; Stockholm, 350; Copenhagen, 302; Vienna, 280; Brussels, 270; St. Petersburg, 206; Berlin, 170; New York, 150.[1]

In India the reported annual death rate from suicide, according to Dr. K. McLeod, ranges from about 50 to 80 per million of population, except in Bengal and the Punjab, which are reported much less.

The **sexual** ratio differs remarkably in English and Indian suicide statistics, in that while in England the suicide death rate among males is three times as high as among females (for the eight years 1887–1905 the proportion is almost exactly 3 to 1), in the different Indian provinces the female suicide rate exceeds the corresponding male rate. Thus in the Madras Presidency, where the rates for the two sexes differ least, the female suicide rate is about one-tenth higher than the male rate; while in the United Provinces, where the rates differ most, the female suicide death rate is on an average about two and a half times as high as the male rate.

Suicides according to Sex per 1,000 Cases (McLeod).

Method.	In Calcutta.		In Provinces.	
	Males.	Females.	Males.	Females.
Hanging	179	346	368	278
Drowning	127	54	354	576
Poison	547	562	168	119
Cuts and stabs	59	16	65	11
Gunshot	37	—	25	—
Otherwise	51	22	20	16

Age.—The suicide rate increases, as in England, from puberty up to fifty or so, and then declines. Child suicide is not uncommon in India.

Mode of Suicide.—The means of suicide vary according to local conditions, such as the presence of a river or lake, or accessibility of weapons or fire-arms, poison, etc. In India, the means chiefly employed are (1) drowning, (2) hanging, and (3) poison. *Drowning* is the mode selected by about

[1] Dr. W. Wynn Westcott, *Trans. Med. Leg. Soc.*, 1904, II 85.

three-fourths of the female suicides of the Madras and Bombay Presidencies, while more than three-fourths of the male suicides in the same provinces hang or drown themselves in about equal numbers. In the Panjab one-half the male and nearly one-half of the female suicides choose *hanging*, while drowning is selected by only about one-third of the females and one-sixth of the males. Hanging, also, is the mode chosen by over half of the female and about one-third of the male suicides of Calcutta. *Poison*, usually arsenic or opium, is chiefly used as a means of suicide in certain special localities, *e.g.* in districts where the poppy is grown, and in the towns of Calcutta and Bombay. For details of suicide by poison, see 'Poisons.' *Gunshot* is more commonly used by Europeans and Eurasians.

The difference in the mode of death selected by would-be suicides in different parts of India is seen in the following table, from which it will be seen that whereas in Calcutta the favourite means is poison, in other parts of India the preference is for hanging, then drowning, and thirdly poison, whilst females prefer drowning, then hanging and less frequently poison.

MODE OF SUICIDE IN 1000 SUICIDES OF EACH SEX.[1]

	Mode.	England and Wales, 1874 and 1875.	Bombay Presidency, 1873 to 1876.	Madras Presidency, 1872 to 1876.	Panjab (two years, 1872 and 1876).	Calcutta (Town), 1872 to 1876.	Madras (Town), 1872 to 1876.
Males.	Hanging ..	274	382	471	500	326	163
	Drowning ..	184	456	443	174	74	623
	Poison	90	91	26	184	453	86
	Cuts, stabs, etc.	280	71	49	26	84	96
	Gunshot ..	82			32	63	32
	Otherwise ..	90	—	11	84	—	—
Females.	Hanging ..	284	185	179	464	519	42
	Drowning ..	309	767	790	354	26	937
	Poison	155	37	26	84	429	21
	Cuts, stabs, etc.	182	11	2	18	26	—
	Gunshot ..	2			—	—	—
	Otherwise ..	68	—	3	80	—	—

The various forms of suicide and questions therewith are detailed under the respective modes of fatal violence, wounds, etc.

[1] K. McLeod, *On Suicide in India.*

PLATE III.

Self-inflicted Wounds, feigning attempted Homicidal Wounds.
(On left upper arm.)

To face p. 151.]

Is the Wound Homicidal or Suicidal or Self-inflicted?

This question is answered by: (1) The *appearance* and *position* of the wound. (2) The *direction* of the wound. (3) The *number* of wounds or injuries. (4) The *position and surroundings* of the injured individual.

1. Appearance and Position of the Wound.

Although in many cases, these characters afford no indication as to how, or by whom, the injury was inflicted, a presumption more or less strong arises from the following circumstances:—

Against self-infliction and in favour of homicide or accident, in the case of stabs passing right through the body, and cut throat extending to the vertebræ, these being rarely self-inflicted wounds.

Case.—**Suicidal cut throat,** wounding vertebra.—Dr. A. Powell relates a case of a European who committed suicide with a razor and hacked the vertebra without wounding the carotids. He did this by throwing his head back during the operation. In this position the carotids are on a plane posterior to the anterior surface of the vertebra.

Case.—A Hindu male, aged 35, committed suicide in the court lock-up, Bankipore, on 17th July, 1897, by cutting his throat with a knife. His body was examined the same day. Marks of injuries: a transverse incised wound in front of the neck, about five inches long and four inches broad, down to the spinal column; the trachea was divided just below the cricoid cartilage; the œsophagus and the right carotid artery were cut through. The divided portions of the trachea were much retracted.—Purno C. Singh, *Ind. Med. Gaz.*, 1902, p. 236.

Case.—Taylor, *Med. Jur.*, I. pp. 512 and 513, mentions two suicidal cut throat cases, in which the spine was wounded. In the first (Ryan's case) there were three cuts on the vertebra, but the large vessels of the neck were unwounded. In the second (Marc's case), respecting which Taylor remarks that a wound so extensive is rarely seen in a case of suicide, the large vessels were wounded, the windpipe and gullet cut through, and the vertebra grazed.

So also stabs, and incised wounds on the back, and gunshot wounds, unaccompanied by any blackening of the skin or scorching of the clothes, are only likely to be self-inflicted if some special contrivance has been used to fix, or in the case of a gunshot wound to fix and discharge from a distance, the weapon employed. Several *contused* wounds are only likely to be self-inflicted if the person is insane, or the case is one of suicide by precipitation from a height.

In favour of self-infliction.—In the case of incised wounds, if these are all slight, or if severe they tail off at one end into a superficial scratch, and are in the accessible position on the

left side in the case of a right-handed individual (see *Plate I.*), the presumption is in favour of self-infliction. In suicidal cases, in about four-fifths of the cases the head is chosen for injury.

Case.—**Self-inflicted wounds** feigning homicidal.—The Lansdowne Road Mystery.—Flora McLeod (see *Plate I.*) was nurse to a European family in Calcutta in 1901. She had the baby of the family in her charge, and one night it was found dead. The nurse ran out into the verandah and alleged that a native had come into her room at midnight and stolen her jewellery, had knocked her down in the bathroom and stabbed her repeatedly and killed the child. The stabs, 14 in number, were skin deep and evidently self-inflicted. The scratches were all on the left upper arm. All were distinct scratches, and considering their length compared with the circumference of the arm, could not have been inflicted by stabbing thrusts with a dagger or knife. The police believed that she produced them with the point of a pair of scissors. They were in a position where she could conveniently produce them with her right hand. The police surgeon gave it as his opinion that they were self-inflicted. The child was 16 months old and was reported to have died of suffocation. It transpired that proceedings for a divorce were being taken against accused by her husband. No trace of the alleged burglar was found.

Case.—**Wounds self-inflicted** in support of false charge.—"In 1853 three native women and two children were found lying dead in a heap with their throats cut in their bungalow at Betul. The husband of one of the females gave the alarm, stating that the crime had been committed by dacoits (gang-robbers), who had also wounded and bound him! It, however, soon became evident that this man was the murderer." . . . His wounds were very slight, the chief one being on the thigh, about "three inches long, and in no part penetrating completely through the true skin"; the others were shallow scratches exactly parallel to the first, and the amount of blood on his clothes and body was much greater than could have flowed from his wounds.—Chevers, *Med. Jur.*, p. 357.

Case.—"A Mussulmani at Dehra Ismail Khan, examined by Surgeon G. P. Mackenzie, in September, 1872, had a slight cut scarcely skin deep, and two or three smaller scratches on throat. She accused her husband of attempting to murder her. The injuries were pronounced to be very trifling, and probably self-inflicted. She was convicted of bringing a false charge, and sentenced to six months' imprisonment."—Harvey's *Beng. Med. Leg. Rep.*, p. 117.

In favour of infliction by another person, in cases where severe incised wounds are accompanied by cuts on the hands of the injured individual, and in female subjects—if the circumstances exclude accident—in cases of wounds of the genitals, or castration, or mutilating wounds of the nose, ears, or breasts. In India, wounds in females in the situations just mentioned indicate jealousy, or punishment for adultery as the motive for their infliction; and wounds of the genitals in male subjects often also indicate the existence of the last-mentioned motive or religious monomania—as melancholics sometimes make a clean sweep of penis, scrotum, and testes. Blows or cuts on

the head inflicted by a right-handed person are usually on the left side of the victim, if on front.

In favour of accident—the location of the wound on an exposed part of the body and one side only.

2. Direction of the Wound.

It may first be noted that while a non-self-inflicted wound may have any direction, a self-inflicted wound usually has a particular direction, dependent on the part wounded and the hand employed. Hence it is important, where possible, to ascertain whether the injured individual is, or was, right or left-handed, or ambidextrous. Next, an endeavour should be made to determine the beginning and ending of the wound: this, of course, presents no difficulty in the case of punctured and non-traversing gunshot wounds. In traversing gunshot wounds, the beginning and ending of the wound are indicated by respectively the orifice of entry and the orifice of exit. It, however, by no means follows that the direction of such a wound is represented by a straight line drawn from one orifice to the other. For example, a projectile may be deflected by a bone or by tough fascia, and take a circuitous course, *e.g.* may be deflected by a rib, and pass half round the body without penetrating the chest, or pass half round the head without penetrating the skull.

Dr. A. Powell cites a case of a sergeant of the 8th Mounted Infantry in the Boer War hit by a Mauser bullet close to the spine. The entrance wound was linear. The bullet travelled right round the ribs and was removed from below the skin close to the sternum between the third and fourth costal cartilage. Had it come out of itself the exit would doubtless have been much smaller than the entrance wound.

In the case of incised wounds made by a drawing-cut, if one end is abrupt, deep, and unbifurcated, and the other shallow, and tailing off, or bifurcated, the probabilities are that the former is the beginning and the latter the ending of the wound. In deep incised wounds, the plane of the wound must be noted (see *Case*, p. 159).

Self-inflicted incised wounds, as a rule, (1) end on the same side as the hand employed, and (2) begin from below if on the lower part, or from above if on the upper part of the body. Self-inflicted incised wounds of the throat, as a rule, possess the first of these characters, but may or may not possess the second, *i.e.* they may be transverse, or run from above down,[1] or from below up. Self-inflicted stabs and gunshot

[1] K. McLeod, from the cases reported in Bengal in 1869, considers that suicidal wounds of the throat are generally high up on the neck, between the

wounds (in right-handed persons) run, as a rule, from right to left.

Homicidal wounds may have any direction, and are specially liable to have the same direction as self-inflicted wounds if the assailant was standing behind his victim, at the time of inflicting the injury (see *Case*, p. 159). Frequently in homicidal wounds the direction of the wound indicates the relative position of the assailant and victim; it must be recollected, however, that the direction of the cutting edge of some weapons is transverse to the line of the handle. This is the case in the carpenter's adze, and the mattock (*gainti*) or spade-hoe (*phaora* or *kudali*) commonly employed by cultivators in India.

3. Number of Wounds or Injuries.

A **single** wound or injury may be the result of accident, self-inflicted, or inflicted by another. When many wounds are present, self-infliction and accident are, to a certain extent, contra-indicated. Multiple wounds may, however, be:—

(*a*) **Self-inflicted.**—Several incised wounds, all slight, are sometimes self-inflicted, with the object of averting suspicion (see *Case*, p. 152); or of supporting a false charge (see *Case*, p. 152). In suicidal cases also, *e.g.* cut-throat, one severe incised wound is sometimes found accompanied by other slight cuts. More than one severe incised wound may, of course, be self-inflicted, but the greater the number the stronger the indication in favour of homicide. Several contused wounds are only likely to have been self-inflicted in the case of insanes, or in cases of suicide by precipitation from a height. Suicide by precipitation excluded, self-infliction is contra-indicated, if each of two or more wounds is of such nature as to cause immediate insensibility, or immediate death. Very severe wounds, however, may not cause immediate death, or immediate insensibility, and hence the existence of two such wounds may still be consistent with self-infliction; *e.g.* Hayes Agnew concludes from recorded cases that it is possible for a suicide to shoot himself "first in the head, and within the lapse of a minute inflict a similar wound on the heart," or *vice versâ*.[1] Very great caution, therefore, must be exercised in drawing a

hyoid and thyroid, more on the right than on the left side, and are either transverse or incline from below upwards.—*Beng. Med. Leg. Rep.*, 1869, p. 57. Casper, however, while admitting the difficulty of ascertaining the commencement and end of wounds, states: "In suicidal wounds of the throat the wound certainly usually runs from left to right and from above downwards."—II. p. 13.

[1] *Annals of Surgery*, Vol. VI. p. 152.

positive inference against self-infliction, simply from the fact that more than one severe wound is present on the body.

(*b*) **The result of accident,** *e.g.* a fall from a height, an accident from machinery, etc. In such a case, however, homicidal violence is not contra-indicated, unless all the injuries are to be accounted for by the supposed accident. Thus when the accident indicated is a fall from a height, and there are no projecting objects against which the body could have struck during its descent, severe injuries on both sides of the head contra-indicate accident (see *Cases,* below and p. 159).

4. Position and Surroundings of Injured Individual.

Under this head should be noted :—

(1) **The position** and attitude of the body and its relation to surrounding fixed or large objects.—This may directly indicate self-infliction or accident, as, for example, when the body is found at the foot of some high object, from the top of which it may have fallen. It must be borne in mind, however, that an attempt is sometimes made to conceal murder by placing the body of the victim in such a position as to point to accident or self-infliction as the cause of the injuries. With this object the body (as in *Case* below) may be placed at the foot of a high tree, or on a railway line, etc.

Case.—**Attempt to conceal** homicide by fabricating evidence of accident.—The body of a man was found at the foot of a mango tree, with a bundle of mangoes tied round the neck. On the body was: (1) Around the lower part of the neck, extending from right side of trachea to posterior edge of left sternomastoid muscle, a brown mark, as if from pressure of a cloth or large cord. (2) Abrasions and scratches with dust adhering, on right front of chest and anterior and outer aspect of right arm. (3) On right side of face and neck several bruises elongated in shape. (4) Bruises and abrasion over right parietal protuberance. Blood in large quantity extravasated under scalp. All right half of the skull broken into fragments, fissures radiate in all directions, all the fragments irregular in shape, and lying loose on the brain. An opinion was given that the injuries were caused by blows from a weapon, not by a fall from a tree. Subsequently one of the accused confessed that he, deceased, and several others, had been stealing mangoes, when a dispute arose as to the division of the plunder, and some one knocked deceased down with a lathi. The body was then conveyed some distance (probably dragged along the ground) and placed under the tree, so that it might appear that a fall therefrom was the cause of death.—Asst.-Surg. Duncan in McLeod's *Beng. Med. Leg. Rep.*, p. 41.

In such cases discrepancies between the nature and situation of the injuries, and the method of production indicated by the position of the body, point indirectly to the employment of homicidal violence. In other cases also indirect indications

of the employment of homicidal violence may be afforded by the position and attitude of the body. This is so when the injuries present are of such a nature as to make it improbable that the position and attitude in which the body was found resulted from effort on the part of the injured individual. For example, the body may be found at a distance from the place of infliction of the injury, or in an attitude widely differing from that in which it must have been in, directly after its receipt, *e.g.* the cause of death being fracture of the skull from a blow on the back of the head, the body is found in an upright position, supported against a high thick hedge at its back. The possibility, however, even when the injuries are extremely severe, of considerable effort on the part of the injured individual must not be overlooked. It has already been pointed out that a certain amount of power of voluntary movement may still be retained after receipt of very severe wounds, and it now may be pointed out that very considerable power of locomotion may remain, even after the receipt of almost immediately mortal injuries.

Case.—**Locomotion** after mortal injuries.—Dr. A. Powell relates a recent case, in which a boy of 18 ran at least 120 yards from where he was mortally shot through the heart. *Post mortem* examination showed that a buckshot had pierced the anterior wall of left ventricle and lodged in the interventricular septum.

Case.—He also gives a case of a man who was stabbed by a pitchfork and was driven three miles and lived in hospital for four hours before he died. The *post mortem* examination showed left auricle to have been penetrated.

Case.—An old man was severely beaten with a split bamboo; after the beating he walked to his house, a distance of about half a mile, and died almost immediately. On *post mortem* examination, the seventh and eighth ribs on each side were found fractured, the spleen ruptured, and the right lobe of the liver all but divided transversely by a bifurcated rupture 8 inches long and 1½ inches deep and broad.—*Ind. Med. Gaz.*, 1867, p. 200, Dr. Hutchinson.

(2) **Condition of surface of the body,** or of the clothes or other coverings thereof.—Important points to note under this head are: (*a*) Peculiarities of the clothes likely to have modified the injury received, or to affect the condition of the weapon used, *e.g.* a thick turban may cause a severe blow from a blunt weapon to produce a simple, instead of a compound, fracture of the skull; or fibres derived from an article of clothing worn over the injured part, may be found adhering to a weapon, and thus indicate it to be the one which was used. (*b*) Stains of blood or other matters. It is possible that these by their nature or position may indicate homicidal violence, *e.g.* stains of seminal fluid on the clothes or body of a female corpse, or a mark of a bloody right hand on the right hand or arm of injured

person. Again, in the case of gunshot wounds, blackening of the skin at, or of the clothes worn over, the seat of the wound, by indicating nearness to the body of the weapon at the time of its discharge, is confirmatory evidence in favour of self-infliction; just as the absence of such marks by affording a contrary indication, is evidence of more or less weight against self-infliction. Stains of mud or dust on the surface of the body, with abrasions in certain situations on the skin, may indicate dragging of the body along the ground, and afford possibly, confirmatory evidence of homicidal violence. (*c*) Cuts or rents on the clothes. Want of correspondence in situation between cuts on the clothes and wounds on the body is often found when the wounds have been self-inflicted for the purpose of supporting a false charge, or averting suspicion.

(3) **Nature,** position, and condition **of objects** on and near the spot where the body was found, or the injury inflicted.—The objects found may be weapons, sharp stones, articles of clothing, fragments of clothes, etc., and these or other objects may bear stains of blood. Again, near the body or place of injury may be found bullet-marks, footprints of persons other than the deceased, or marks indicating that a struggle has taken place. If a weapon is found, its position is of importance. This may indicate self-infliction, as, for example, when the weapon used is found tightly grasped in the hand of the dead body, as already instanced. A weapon, however, found loosely lying in the hand of a dead body, may have been placed there, with the view of fabricating evidence in favour of suicide (see *Case*, p. 159). The discovery of the weapon used, at a distance from the body, indicates homicide, in proportion to the improbability of its having been placed where it was found, by the deceased. Here, obviously, the question of what power of effort or locomotion remained to the deceased after receipt of the injury, must be considered. As regards the nature and condition of the weapon found, it may be pointed out that peculiarities in its shape, etc., by their agreement with the shape of the wounds on the body, may indicate it to be the weapon which has been used, and this again may be confirmed by the weapon showing signs of recent use. Marks, again, indicating ownership, present on the weapon, may be important as evidence in favour of the guilt or innocence of the accused. The non-discovery of the weapon used, especially if the injuries are likely to have caused rapid death or insensibility, obviously points to homicide. As regards sharp stones, the presence or absence of these is of importance as indicating the possibility or otherwise of the injuries being caused by forcible accidental contact therewith.

A compound fracture of the skull, for example, a common result of a blow with a blunt weapon, may be caused by a fall on a sharp stone, but is an exceptional result of a fall on a flat surface.[1] As regards articles of clothing or fragments of clothes, the presence of these near the body, or grasped in the hands of the deceased, may indicate that a struggle took place shortly before death between the deceased and some other person, and thus indicate homicide. Fragments of hair, again, belonging or not belonging to the injured person, may be found in similar situations, or adhering to weapons, and may prove of much importance in evidence. Stains of blood may be found on a weapon indicating its recent use, or on other objects in the neighbourhood of the body or the spot where the injury was inflicted. Sometimes the appearance and position of such stains is important as indicating the circumstances under which the injury was inflicted (see *Cases*, pp. 153 and 159).

Case.—**Circumstances under** which wounds were inflicted inferred from position and form of blood spots.—In the case of Spicer, a woman was killed by a fall down a stair, fracturing her skull and spine. A branch of the right temporal artery of the deceased was found divided, and on the wall at the top of the stair, on the right hand going up, several spots of blood were found, of the form and appearance of spots resulting from the spouting of a small artery. From the form and position of these spots, it was probable that deceased received a blow on the head while ascending the stair, and fell backwards to the bottom, the fall causing the injuries which resulted in her death.—Taylor, *Med. Jur.*, I. p. 549.

Bullet-marks or shot-holes, by their situation, may indicate the position of the assailant at the time the weapon was discharged (see *Cases* below). The distance at which the shot was fired is usually related to the question of premeditation, as it is manifest that a shot fired from a considerable distance could not have been fired in the heat of a sudden quarrel.

Case.—**Evidence from bullet-marks.**—Several shots were maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and struck against a wall on the other side of the church. A straight line from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained that the shots had been fired.—Taylor, *Med. Jur.*, I. p. 689.

Case.—"Sir Astley Cooper, called to see Mr. Blight, of Deptford, who had been mortally wounded by a pistol-shot, inferred from an examination of the localities that the shot must have been fired by a left-handed man. The only left-handed man on the premises at the time was a Mr. Patch, a particular friend of the deceased, who was not in the least suspected. This man was, however, subsequently tried and convicted of the crime, and made a full confession of his guilt before execution."—Woodman and Tidy, *Med. Jur.*, 1091.

[1] *Beng. Med. Leg. Rep.*, p. 53.

As regards **footprints,** Ogston[1] remarks that the impression left by the naked foot varies in the same individual according as to whether he was standing, walking, or running at the time. Lastly, objects in the neighbourhood may be found overturned, broken, or showing marks of injury, pointing to a struggle having taken place.

As an illustration of the application of many of these points to a particular case, which in itself exhibits many points of interest, the analysis of the case of the *Empress* v. *Sudhabode,* by Dr. E. G. Russell,[2] is interesting also as a case of special pleading for the prosecution.

Some of the obvious defects of Dr. Russell's reasoning are pointed out in remarks enclosed within square brackets. He does not appreciate the fact of the extreme rarity of "cadaveric spasm"; nor does Taylor if by "thus frequently" (p. 164) he refers to cadaveric spasm. It is time the profession recognizes the extreme rarity of cadaveric spasm. Nor does he think it probable that a razor could be notched by striking the bone in suicidal cases; whereas Professor Powell has cited a case of a razor notched by undoubted suicides in which he found the steel fragments embedded in the vertebra. Nor can anything be inferred from the "expression" of a corpse; the muscles of expression relax in death, and practically all faces are placid unless decomposition has set in, or the jaw has dropped—phenomena which have nothing to do with the passions or temper of the man immediately before death.

Case.—**Fabrication of evidence of Suicide in Homicidal cut-throat.**—*Imp.* v. *Sudhabode Bhattacharji.*—A native girl, aged 11 years, was found dead in her bed with her throat cut, and a blood-stained razor in her right hand. She and her husband had retired to their bedroom at 10 P.M. on the 12th September (1888); the husband left the house at 4 A.M. on the 13th; information of the girl's death was given to the police at about 1.30 P.M. on the 13th. *Post mortem* examination was held at 7.30 A.M. on 14th.

THE POINTS WORTHY OF SPECIAL NOTICE WERE:—

1. Absence of all signs of a struggle, such as cuts on hands, bruises (either on, or beneath, skin), marks of ligature (compression of nose, or mouth); hair not disarranged or cut; clothes not torn or cut.
2. Face calm, eyes half open.
3. Trachea divided between 4th and 5th rings (*i.e.* near sternum), while the wounds of spine were 1½ inches or more higher up. [Dr. R. uses 'spine' very frequently, meaning doubtless spinal column or vertebra.]
4. Three wounds of spine and of gullet, although tissues of right side

[1] *Lect. on Med. Jur.*, p. 63.
[2] *Ind. Med. Gaz.*, 1889, pp. 33, etc.

of neck marked by *one* incision only like those on left side; tracheal wound also single.

5. Plane of wound upwards; direction transverse, crescent-shaped; both ends equally high.

6. *Rigor mortis* well marked and universal; both hands in identically same attitude as regards fingers, and firmly fixed so by *rigor mortis*.

7. Razor loose in right hand, not clasped or even touched by the fingers.

Points establishing Homicide.—I. Wounds.—(*a*) Severity. (*b*) Order. (*c*) Direction. (*d*) Redundancy. (*e*) Plane. (*f*) Lowness on neck. (*g*) Regularity. II. The bleeding.—(*a*) Direction. (*b*) Nature of stains on right hand and arm and on clothes. III. Razor in right hand—value of this fact. IV. Death almost instantaneous. V. Wounds were inflicted during life, and were the cause of death. VI. Absence of cries and of signs of struggle. Each of these points deserve separate consideration.

I. Wounds.—(*a*) The severity. The head was nearly cut off; both common carotid arteries, both internal jugular veins, the pneumogastric and phrenic nerves on both sides, all the muscles of front and sides of the neck were divided, as were the trachea and œsophagus; the cervical spine was cut. In addition to this wound, there were two others, each reaching to and wounding the spine. It will be shown (*b*) that the upper and great wound, which divided every structure of front and both sides of the neck, was probably the first inflicted. After infliction of such a wound, could deceased have inflicted two others, each penetrating to and wounding the spine, and each involving a distinct and determined act of volition? Taking the wounds in any other order, could a suicide have inflicted the two others after any one of them? It is true that authorities on legal medicine have stated that severe and extensive wounds of the throat have been inflicted by suicides (Guy, 3rd Edn., p. 298). Taylor (3rd Edn., 1883, Vol. I. p. 513) also says, "there is no ground for the assertion that extensive wounds of the throat are incompatible with self-destruction." This is, however, qualified by a further opinion expressed by Taylor (*idem.*, p. 519) peculiarly applicable to the present case, which will be quoted later on (in case *Reg.* v. *Edmunds*). The extensive nature of the wounds must, moreover, in the present case, be considered in relation to the age, sex, and state of mind of deceased, the race tendencies, and the nature of the weapon used. Deceased was an immature, non-muscular girl of 11 years. The tendency of female suicides in India, especially of those of tender years, is to destroy themselves by means (poison, hanging, etc.) other than the use of cutting weapons. Moreover, although, as is well known, insanes will inflict on themselves injuries extreme in severity, and showing astonishing persistence and determination (see Taylor, 3rd Edn., 1883, Vol. I. p. 512), yet there was no allegation or question of insanity in the case of deceased —the evidence, in fact, indirectly establishing the reverse. With regard to the weapon found in the right hand, and with which the wounds must have been inflicted had they been suicidal, this was a razor of ordinary pattern. Deceased can have had no skill in the use of such a weapon; could have had no occasion probably ever to have handled one. Yet to have inflicted wounds in any way approaching in severity those found on deceased, a suicide would require some knowledge of the use of a razor, and must certainly have exerted a degree of muscular strength which the deceased, an immature, non-muscular girl of 11, did not in my opinion possess. In most of the cases in which exceptionally severe injuries have

been self-inflicted—more especially by women—the weapon has been a knife with a fixed handle, lending itself readily to a firm grip—not a razor, with a loose blade. (See below.) It will be instructive to compare with the present case, certain others which are collected by Taylor as typical of exceptionally severe injury in cut-throat cases.

Case.—**Suicidal cut-throat.**—Woman; spine wounded in two places, *but* through muscles of back and of side of neck; left internal jugular vein opened; all other large vessels escaped, and *all* the large nerves; other incisions. (Taylor, 3rd Edn., 1883, Vol. I. p. 528.) Note.—Person, an adult; maniacal; weapon, a table knife, *i.e.* with a firmly fixed handle easy to grip; all large vessels and nerves escaped injury—except left internal jugular vein; the spine was reached (and wounded) through the back parts of neck, not through the *front*, where the important structures lie. Taylor says of this case that it "*might* be suicidal"; but the verdict was one of murder. [Here Dr. Russell disregards the verdict in heading case "suicide."] Compare present case:—All large vessels and nerves of neck divided; spine cut in three places, girl of 11, weapon (razor) with loosely jointed handle, no grip; no suspicion of lunacy.

Case.—Ryan's case.—Man; three cuts on spine of neck; *but* both carotids and jugulars escaped, and therefore, almost necessarily, all large nerves. (*Ibid.*, p. 512.) Quoted as a case of exceptionally severe injuries for a suicide—even for an adult male, probably accustomed to use of a razor.

Case.—Marc's case.—All muscles of front of neck, the windpipe, gullet, both jugulars, both carotid arteries divided: and the weapon had "even grazed the anterior ligaments of the spine." Taylor adds (*ibid.*, p. 513), "A wound so extensive as this is rarely seen in a case of suicide . . ." Compare present case:—All great arteries and veins and nerves of neck divided and not merely anterior ligaments of spine "*even* grazed," *but* three incisions into spine of neck. Although the above three cases are placed on record as of exceptional severity for suicide, yet in no one of them is there an approach to the severity of injury found in the present case; even though in the former, all the conditions favoured exceptional severity, viz. adult age, male sex, or if a woman, the presence of mania and the use of a knife with fixed handle.

Case.—Reg. v. *Edmunds.*—Three incisions, front of neck; all the great vessels and nerves divided; also trachea and gullet; two wounds of spine, deep ones. This greatly resembles the present case (K. Manini Debi). Held (although deceased was an *adult*) that "it was impossible for any person to inflict such injuries on himself." Taylor adds: "The hacking of the spinal column in two distinct places . . . *after* [what evidence that it was after?] the carotid arteries and jugular veins had been cut through was alone sufficient to justify this opinion. Suicide may graze the ligaments in front of the spinal column, but that they should make deep incisions into the bones . . . is a proposition contrary to all [not so] experience and probability."—*Ibid.*, p. 518.

Case.—Case of *Earl of Essex.*—To the effect that repeated wounds of the front of spine could not have been self-inflicted, because the division of the vessels and nerves, which must have first been cut, would have rendered the person powerless. When, in these cases, the injuries were held to have been impossible of self-infliction, even by adults, can it, for a moment, be accepted that injuries of as great severity could, in the present case, have been self-inflicted by an immature girl of 11 years of age? I maintained the improbability—nay, impossibility—a view which the jury unanimously endorsed. His Lordship, in summing up,

observed: "On this point, there was not a doubt in the world the wounds were homicidal and not suicidal."

(*b*) and (*c*) Direction and order of infliction of the three wounds of the neck. The great wound had the appearance of having been inflicted from left to right; for its left extremity was shallow for two-thirds of an inch, and then rapidly deepened; while its right extremity ended in a shallow tail 1½ inches long, the skin being alone injured at its termination. This great wound had apparently been caused by a single sweeping incision; for its upper margin was entire and clean cut: neither skin nor tissues showing any sign of two incisions having run into one another; no notch or tag anywhere. Now, although the spine and gullet had three incisions in them, the windpipe and the divided tissues of the right side of neck had only a single incision through (or touching) them, just as those of left side had. How was this to be accounted for? It seems clear that the two lower wounds, which showed superficially a little to left of median line of neck for ½ inch, and then disappeared into the great wound, must have found a gaping opening and dropped into it straight to the spine, which each wounded. A previous incision must have existed, and the tissues have been gaping from its retraction.

If it be assumed that either of these lower wounds was the first inflicted, then the tissues of right side of neck must have been divided by it; these had only one incision; therefore, in that case, the great upper incision which began on left side of neck cannot have cut the tissues of right side, and therefore must have joined in, towards the median line, with the pre-existing one of right side. Had this been so, it is scarcely possible that there should have been no sign of the junction. There was none. The upper margin of the great wound was clean cut and entire through its whole length. The great incision round both sides of neck was then the one first inflicted. This being granted, the improbability of deceased having been able to inflict the other two wounds is far greater than if either of the lower ones had been the first; as the former divided the structures of both sides of neck, the latter could only have divided those of the right side. Not only the great upper wound, but also the two lower ones must have been inflicted from left to right. For, had they been inflicted in reverse direction, what could have caused them to leap up almost vertically from the spine (which they cut) nearly 1½ inches to become superficial almost at once? It was not contact with the inner end of left clavicle, for this was untouched; nor mere contact with the spine, for the great incision wounded the spine equally, and still kept on its deep path.

The appearances were only capable of explanation on the supposition of the two lower incisions having begun as the shallow incisions described on the right side of median line, and, therefore, having been inflicted from left to right. The mere direction of all the incisions—from *left* to *right*—had no great practical bearing on the question of homicide *v.* suicide, for deceased, a right-handed person, would herself have cut in that direction. The direction is that in which a right-handed person inflicting the wounds, homicidally, from behind deceased, would have made them; this fact supports the theory advanced as to the method of commission of the homicide.

(*d*) Redundancy and severity of the wounds was marked and far in excess of what was necessary to take life. That redundancy is far more frequent in homicidal than in suicidal wounds is well known. The frequency of cases of attempt to commit 'suicide' in the Police Courts and Hospitals is confirmatory of this question. Dr. K. McLeod has shown that Indian records firmly establish this fact (*Med. Leg. Ret., Beng.*, 1869).

(*e*) Plane of wounds, upwards. This is rare in *suicidal* wounds; more common in homicidal ones; most common when the latter have been inflicted, from behind, on a person lying down. In the latter case, the plane of the wound is almost necessarily upwards. Proofs that the plane was, in this case, upwards:—

1. Skin and soft parts.—Although retraction had greatly altered the relative position of the parts; yet, taking the upper margin of the great wound, its ends were from 1½ to 2 inches higher than its middle.

2. Tracheal wound.—This was, in front, between the 4th and 5th rings; posteriorly, it divided, obliquely upwards, the ends of 4th ring.

3. Incision of spine.—Plane upwards.

4. The difference in level between the wound of the trachea and those of the spine (behind it) was about 1½ to 2 inches. The tracheal wound, between 4th and 5th rings, was on a height with lower third of body of 7th cervical vertebra. "The lower wound of spine was at upper part of body of 6th cervical vertebra; the higher was on lower part of body of 5th. The wound had, in passing from windpipe backwards to spine, risen about 1½ to 2 inches. If the head of deceased had been drawn backwards at time of infliction of the wounds, this would, no doubt, account for much of the difference of level; but not, I think, for all. For, in my experiments (on the dead subject), I could not raise the level of the 5th ring of the trachea more than one inch, even by traction of the head backwards, which sufficed to draw the body along the table.

(*f*) Lowness in the neck of the wounds. Suicidal wounds are rarely low in the neck; they are usually high up, in a region of hyoid bone or larynx. Homicidal wounds are frequently low down. General experience confirms this (see also Taylor, 3rd Edn., 1883, Vol. I. p. 512).

(*g*) Regularity of the wound has been held to indicate suicide by some, homicide by others. In the case of a struggle, it is probable that a homicidal wound would be irregular. But, on the other hand, "a murderer by surprising his victim from behind, . . . by directing his attack against one who is asleep . . . may easily produce a regular and clean incision of the throat."—*Ibid.*, p. 513. A suicide requires a steady nerve to make a regular, clean-cut wound, especially when a large one. Could a girl of 11 years of age be credited with the amount of nerve required to nearly decapitate herself with steadiness and regularity?

II.—The Bleeding.—(*a*) Direction of the blood effused. All the blood effused from the wounds of the neck had run directly backwards, towards the back, sopping with blood the posterior parts of the body and trunk. There were no marks of any stream of blood having run down the neck, chest, shoulders or clothes, *i.e.* in direction from head to feet. This shows that deceased must have been lying on her back during the whole time that bleeding was going on, *i.e.* from infliction of wound to death. This fact was of the highest practical importance in the case. For I gave it as my opinion that it was impossible for deceased, while lying on her back, to carry a razor so far round the throat as the wound extended (*i.e.* all around, except for 1½ inches behind), and at the same time keep the cutting edge against the throat; on the right side (the right hand being used), the hand could not be got round so far unless the head were raised to enable it to get beneath. That deceased's head was not so raised is almost certain, for had it been, even for a moment, blood would have streamed down the neck and chest or shoulders, and told the tale; for bleeding was at that time going on, the vessels having been severed. There were no marks of any such streams.

Moreover, it is rare for a suicide to cut the throat in a recumbent posture. (Taylor, Vol. I. p. 545.) See also cases: *Reg.* v. *Courvoisier*, *Reg.* v. *Constance Kent*, and *Reg.* v. *Gardner*.

(*b*) Nature of the blood-stains on right hand and arm. The right hand had blood-stains over every part, as if dipped in blood. The right forearm was free of blood, except along its lower and inner edge, where it had lain in contact with the blood-sopped clothes. There was no mark of a jet or spurt of blood, nor of any individual drops, on this hand or arm or on clothes of deceased. If the case had been one of suicide, the right hand (containing the razor) must, at the moment of severing the vessels, have been in close contiguity with them. The arteries, especially the smaller ones, would have at once jetted out blood on being cut. Could the hand and forearm, if naked, or the clothes, if covering them, have completely escaped being marked by such jets? They had entirely escaped.

III.—Razor in right hand—value of this fact. At the time of *post mortem* examination, the razor was found loosely supported in the right hand between the upper phalanx of thumb and the palm; the fingers did not touch. The case was, however, complicated by the razor having been removed while the body was being conveyed to the dead-house, and afterwards replaced before I saw it. The Inspector, who saw the body *in situ* on the bed before removal, deposed that the razor was at that time not tightly clenched, that he removed it easily without any force, his object being to prevent it falling out and getting lost on the way. The defence strongly contested the point whether the razor could not at some earlier period than that at which I examined the body have been firmly grasped by cadaveric spasm. It was admitted that, had the razor been firmly grasped by cadaveric spasm, it would have been telling evidence in favour of suicide.

Taylor notes (Vol. I. p. 65): "Razors and pistols are thus *frequently* found in the hands of suicides." Had it ever been so grasped, in the present case, it could scarcely have arisen from any cause other than the fixation by cadaveric spasm, at the moment of death, of a voluntary grip of the weapon during life. For this condition cannot be artificially induced after death. I maintained that there was proof that the weapon had never been fixed in a tight grasp by cadaveric spasm. For, had it ever been so clenched, the razor could only have come into the loose state found by me owing to one of two causes, viz. either by the fingers having been opened by some one, or by the subsidence of cadaveric spasm. That neither of these causes had come into play was clear from the fact that *rigor mortis* was still present and well marked in the fingers of the right hand, as elsewhere, at the time of my examination. Had the fingers been unclasped, by any person, from a grasp of the knife, cadaveric rigidity (*rigor mortis*) would have, to that extent, been destroyed so far as these fingers were concerned, and, once destroyed, could not have been restored. Yet I found it strongly present; the fingers were rigid and resisted flexion. The hand had, therefore, never been unclasped, and, therefore, can never have had a tight grasp of the razor fixed by cadaveric spasm.

It was suggested by the defence that a tight grasp of the razor may have been fixed by cadaveric spasm at the moment of death, but that a supervening stage of general relaxation may have loosened it, and this loosened stage have been found and fixed by supervening *rigor mortis*; and that this would explain the condition found. The answer is plain; that cadaveric spasm is *rigor mortis* (early in setting in), and that, when relaxation ensued, there would be no further (or second) *rigor mortis*. There were two other points indicating that the position of the fingers of

the right hand had not been altered by any person, namely, that the position of the fingers of both hands was identical, finger for finger, joint for joint, and that the members of both hands were in the position commonly found in death from whatever cause, *i.e.* thumb close to palm, its last phalanx and the two lower ones of each finger semi-flexed. It would have been a remarkable coincidence if the right hand had, after having been opened, been recomposed into such identity of position with the left. The absence of a tight grasp on the razor is, however, no direct proof of homicide; it merely destroys *one* proof of suicide. For a razor may be found loosely held in the hand of a suicide owing to cadaveric spasm not having occurred, the weapon having continued to lie in the hand during the ordinary after-death stage of relaxation, and this relaxed state of the hand having become fixed by *rigor mortis* eventually. On the other hand, a razor put into the hand of deceased after death would have been found in precisely the condition in which I found the weapon in the present case. (For cases illustrating this, see Taylor, 3rd Edn., 1883, pp. 67 and 519; the Saville case, the Gardner case, also Tidy, Part I. pp. 121 *et seq.*).

IV.—Death almost instantaneous. This naturally follows from the whole of the large vessels and nerves of the neck having been severed. That death was not quite immediate is shown by the presence of blood-stained froth in the larynx, below its severance, and in the bronchi: deceased must have breathed after division of the trachea and blood-vessels.

V.—The wounds were inflicted during life. For the defence, it was argued that the wounds of the neck might have been inflicted *after death* from some other (natural) cause; and that wounds, caused immediately or soon after death, were not distinguishable with certainty from those inflicted during life, that therefore I was not warranted in giving a definite opinion that they were actually inflicted during life and were the cause of death. So far as the appearance merely of an incised wound is concerned, Taylor and Aston Key found that one inflicted within two or three minutes after death showed considerable resemblance to one inflicted during life. In the present case, however, the extreme retraction of the divided skin and muscles, and the free ecchymosis into margins of tissues bounding the wound, show this to have been inflicted during life. But it was not necessary to look to the wounds alone for evidence on this point; the amount of blood loss, every part of the body being drained of blood, even parts so remote from the wounds as the kidney, vagina, etc., the empty and contracted condition of the heart cavities, all confirmed the conclusion that the large vessels were opened by the wounds during life. Division of these vessels, after the heart had ceased beating, could not have emptied the body of blood to anything approaching the degree found in the present case.

VI.—Absence of cries and of signs of struggle. This was *primâ facie* evidence in favour of suicide. This absence can, on the other hand, be accounted for on the supposition that deceased was taken unawares and a disabling wound at once inflicted. There is much other evidence to support the theory that this really occurred. Ecchymosis might reasonably have been absent, even had deceased struggled, if restraint had been applied with the interposition of some soft medium, such as the prisoner's own clothes. If such a medium had been used over head and face, it would probably have been stained with jets of blood. It should be noted that the clothes which the prisoner is believed to have worn at the time of the alleged murder, were not forthcoming for examination. There may have been marks of jets of blood on them. I further

expressed the opinion that even had (say) the face, mouth, hands, etc., been subjected to firm holding or compression, such as would ordinarily have left bruise marks, yet in the case of deceased, the hæmorrhage must have been (from the great size and numbers of the vessels divided) so rapid and copious, that it is quite conceivable that no blood would be left to effuse and ecchymose at the region compressed. Deceased was not drugged into helplessness; the stomach was found healthy, empty, and free from anything which could excite suspicion.

Points tending to fix the Crime on the Prisoner.—1. The period at which death of deceased occurred. 2. Could the wounds have been caused by the razor found in the right hand of deceased? 3. Were the wounds inflicted on the deceased while asleep? 4. *Rigor mortis*, as a test of the time dead.

1. Hour of death of deceased. This point was of the gravest importance to the prisoner; and, as such, the opinion expressed was subjected, by the defence, to prolonged and searching criticism. The following were the facts involved:—Deceased had taken a meal of *chupatties*, curry, and rice a little before retiring to rest at 10 p.m. with her husband (the prisoner); she was not again seen alive; prisoner left the house at 4 a.m.; deceased was found dead with her throat cut before he returned. The question to be determined was—did death occur during the period 10 p.m. to 4 a.m., during which the prisoner was in her room, or did it occur after his leaving the house? If the murder was not committed before his leaving the house, then the prisoner was not guilty. The degree to which digestion had advanced was the factor employed to determine whether or not death occurred between the hours mentioned. At the *post mortem* examination the stomach was found quite empty; food, thick and fluid, which had recently undergone gastric digestion, was present in the upper small intestines, duodenum, and jejunum. From the fact of this food being present in the duodenum, it was clear that the stomach had but quite recently become empty. The period of ingestion of the meal was known, and the nature of the food taken. The question remained—in how many hours would the gastric digestion of such a meal be completed and the stomach left empty? If this had taken more than six hours (*i.e.* from 10 p.m. to 4 a.m.), then deceased died after prisoner left the house, and during his absence. Dr. Beaumont (in experiments on Alexis St. Martin) found that rice was digested in one hour; barley, milk, fish, in two hours. He refers to gastric digestion. His conclusions have never been disputed by any authority (see Appendix V. for details, also for Indian observations). Other authorities have given periods of from 2½ to 5 hours as those required for the stomach to become empty after an ordinary meal (McKendrick, Pavy, M. Foster, Todd and Bowman, Carpenter, etc.). By an ordinary meal they mean an ordinary European meal consisting of meat, vegetables, bread, etc. Meat and other highly nitrogenized foods take longer to undergo gastric digestion than such starchy foods as rice, wheat, etc. For a meal of rice and *chupatties*, then, a shorter time must be allowed for gastric digestion. Sleep retards digestion, though it is impossible to express this retardation definitely in hours. Digestion is more active in the young. Deceased was 11 years of age, and was, presumably, asleep during all, or some part of, the time she was in bed, between 10 p.m. and 4 a.m. It will be seen that it was not possible to state, in hours, the exact time occupied in digesting her last meal; so many modifying circumstances, including those above noted, being present. Taking everything into account, I gave the opinion that the period required to bring her last

meal into the condition found on *post mortem* examination would be at the outside, 6 hours—more probably some hours less. Dr. K. McLeod, speaking as medical expert, gave the period as from 3 to 6 hours—nearer the former than latter. The death was thus shown to have occurred before the prisoner left the house—in all probability.

2. Could the razor found in the hand of deceased have been the weapon with which the wounds were inflicted? I held that it could. The question was raised by the defence, in the interest of the prisoner; the razor having been proved to be the property of the prisoner. To have caused the clean-cut, even, upper margin of the first and great incision, the razor must at that time have been sharp edged. The soft tissues in front of spine must necessarily have been divided before the razor could have cut the bone of the spine and have thereby become notched. The edge would, therefore, have remained uninjured during the incision through the tissues of the left side of neck; the part of the razor—the point—which penetrated to the spine may then have become notched on its edge, but the remaining part of the incision through the tissues in front of spine (*i.e.* on right side of neck) would be made (even and clean-cut) by the heel of the razor which, being less deep in the wound, would impinge on the less deep tissues, and which would not have engaged the deep-lying spinal bones, and so not have lost its keen edge. The second and third wounds scarcely touched the tissues of the neck; they fell almost immediately, through the gaping first wound, on to the spine; so that the whole length of razor probably impinged on the bone, and became notched on its fine edge. Could a sharp razor have had its edge turned, and finally notched (as was that found in hand of deceased) by contact with the bones of the spine (these three wounds of spine)? It probably could. On this point, see case of Earl of Essex (Taylor, 3rd Edn., 1883, Vol. I. p. 519); in discussing which, Taylor does not dispute the fact that the edge of a sharp razor could be notched by wounding the bones of the spine—he merely affirms that deceased could not have himself done this.

3. Was deceased murdered while asleep? There are a number of reasons for thinking so:—(1) The placid appearance of the face was eminently consistent with the taking of life during sleep. (2) The characters of the wound of neck. Its crescentic shape, the ends being 1½ inches higher than the middle, its plane being sharply upwards, points to the great wound having been inflicted from behind while deceased was lying on her back; its clean-cut regular margin points to it having been caused by a steady stroke while deceased was quiet and unresisting, probably asleep. (See case *Lord W. Russell*, *Reg.* v. *Courvoisier*, Taylor, 3rd Ed., p. 513.) (3) The direction taken by the effused blood, shows her to have been lying on her back when the great wound was inflicted, and to have been so disabled by it as to have not moved afterwards. (4) The absence of marks of a struggle, although deceased was not drugged nor apparently forcibly held.

4. *Rigor mortis* as test of time dead. The defence made an attempt to fix the death by this means at a period subsequent to the prisoner having left the house, and thus to clear him of the murder. As the body after death had to cool through one degree of temperature only the existence of *rigor mortem* at the time of the *post mortem* examination was in keeping with death occurring before prisoner left the house. The accused was convicted and sentenced to death.

Results Following, or Likely to Follow, the Injury?

The reply to this question must be cautiously given, as the result of injuries, whether disabling, mortal, or otherwise, depends on a variety of circumstances, especially on: (1) the part injured; (2) the nature and extent of injury; (3) the state of health and age of the injured individual.

Where death has not occurred the questions will be:—"Is the wound dangerous to life?" or "Is it likely to leave permanent injury or incapacity?" The former question can be answered from the details already given with reference to the particular part injured. Secondary dangers are, secondary hæmorrhage, tetanus, septicæmia, and erysipelas. The second question is more likely to arise in civil cases claiming compensation for loss of wage-earning capacity than in criminal, where the intent to injure is the chief factor in awarding punishment. This would be answered on general principles. The question of whether nervous shock is temporary or permanent is the most difficult to answer. '*Grievous hurt*' may sometimes follow, secondarily, as an indirect consequence of an injury, when inflammatory action leads to a stiff joint, loss of hearing, etc., etc.

Where death has followed the injury, it is necessary to satisfy yourself that all the organs are healthy before you can ascribe the death entirely to the wound or other injury.

Causes of Death, etc., in Wounds and Mortal Injuries.

Some injuries causing death may be called "conditionally mortal" injuries, *i.e.* such as cause death owing to either (1) Disease or infirmity, under which the injured individual labours, *e.g.* an enlarged spleen; or (2) The supervention of disease, *e.g.* tetanus, septicæmia, erysipelas; or (3) Want of resort to proper remedies or treatment, as when death occurs owing to loss of blood from a wounded artery of moderate size, such as the brachial. Others may be called 'mortal' injuries, or injuries intrinsically sufficient to cause death, irrespective of the existence of any conditions such as those above mentioned.

Death from a mortal injury may occur by: (1) Coma, *e.g.* from pressure on the brain of fragments of bone or effused blood; (2) Asphyxia, *e.g.* from paralysis of the movements of respiration, or mechanical interference with this process; (3) Syncope from loss of blood, or from mechanical impediment to the heart's action; or (4) Shock, as in death from concussion of the brain, or from the effects of a violent blow over the region of the solar plexus.

In some cases, difficulty may be experienced in tracing the connection between death and an injury proved or alleged to have been received; thus, in the case of injuries alleged to have been caused by the action of external violence on a diseased organ, it may be difficult to determine whether the injury to the organ in question was or was not the result of external violence. In cases of this class, much will depend on (*a*) the liability or otherwise of the affected part to rupture from causes other than externally applied violence (see 'Rupture of the Spleen,' 'Injuries to the Brain,' etc.); and (*b*) the presence or absence of marks of violence on the surface of the body over the injured part, or in the tissues situated between it and the surface of the body.

Case.—**Assault not homicide** in rupture of enlarged *spleen.*—*Reg.* v. *Bysagoo Noshyo.*—Accused quarrelled with his wife and gave her a kick, which ruptured her spleen. He repented immediately and was found with the woman in his arms helping her. Acquitted under *ss.* 320 and 322 of Penal Code, but found guilty under *ss.* 319 and 321. Sentence: One year's rigorous imprisonment.—8 *W.R.*, Cr. 27.

Case.—*Reg.* v. *Robert Bruce.*—Accused was tried for 'causing hurt' by kicking a boy who was suffering from diseased spleen. Death was the result of the kick. The judge held that the prisoner had no intention of causing death, but, considering the dangerous consequences of such an act, especially when inflicted on a native in this country, sentenced him to six months' rigorous imprisonment.—*Calcutta Criminal Court*, June, 1868.

When a conditionally mortal injury is alleged to have caused death owing to the supervention of disease, it may in some cases be very difficult to decide whether or not the disease is really to be attributed to the injury.

In England the law seems different, for, according to Lord Hale, "if a man be wounded and the wound, although not in itself mortal, turn to gangrene or fever, this is homicide in the aggressor; but though the fever or gangrene be the immediate cause of death, yet the wound, being the cause of the gangrene or fever, is held the cause of death—*causa causati*. It is sufficient to constitute murder that the party dies of the wound given by the prisoner, although the wound was not originally mortal but became so in consequence of negligence or unskilful treatment." "If a man," says Lord Hale, "has a disease which, in all likelihood, would terminate his life in a short time, and another gives him such a blow as hastens his death, this is such a killing as constitutes murder." Disease of the spleen, however, is not even a disease which need necessarily prove fatal.

Mortal injuries causing death by coma, asphyxia, or hæmorrhage leading directly or indirectly to syncope, are not likely to present difficulties of the kind just alluded to. In some cases, however, of death from shock, it is possible that it may be very difficult to trace the connection between death and the alleged violence. With reference to this, it may be pointed out that death from shock may occur: (1) without any mark

of violence being present—this has been often observed in cases where the fatal shock has been due to a violent blow over the region of the solar plexus; or (2) a single slight bruise only may be present as in many reported cases of fatal concussion of the brain; or (3), as often occurs in cases where persons have been severely beaten, from the combined effect of a number of slight injuries, each by itself totally insufficient to account for death. In cases such as these, it is especially important that the *post mortem* examination should be complete, as much may depend on the medical officer being able to state (if it be so) that no appearances were present indicative of a cause of death, other than the alleged violence.

Examination of Stained Articles, Blood-Stains, Seminal, and other Stains.

Stained weapons, clothes, bits of furniture, plaster, mud, etc., may be sent for examination in cases of alleged wounds, rape, and unnatural crime. These stained articles are usually passed on by civil surgeons, for want of the requisite apparatus and test materials, to the chemical examiner for his expert report. In sending such articles the same strict precautions as to labelling, sealing, etc., must be taken as in poisoning-cases (*q.v.*).

Preliminary Examination of Stains.

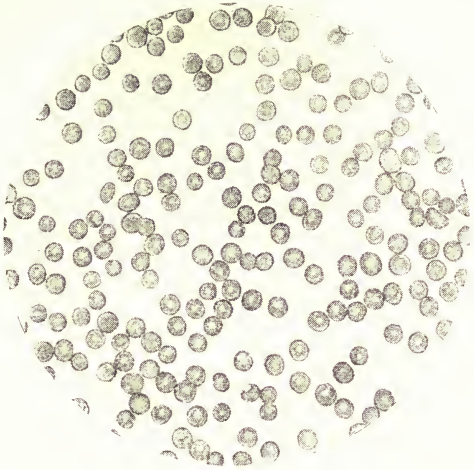
1. **Note** down carefully an exact description of the stained articles, weapons, etc., submitted to you for examination, to enable you afterwards to identify the articles, as the whole case may break down if you cannot identify in court the article from which you have examined the stain. Note the number, shape, size, colour, consistency of stains, on what part of weapon and on which side of the garment, the inside or outside; and if more than one garment stained, whether they are stained in a corresponding part. In important cases a *photograph* should be taken of the stained garment or article before removing any of the stain.

2. **Cut out part** of the suspected stain from the article, and divide each part into at least three portions for tests and control purposes, and carefully preserve as much as possible of the original stain for exhibit afterwards in court.

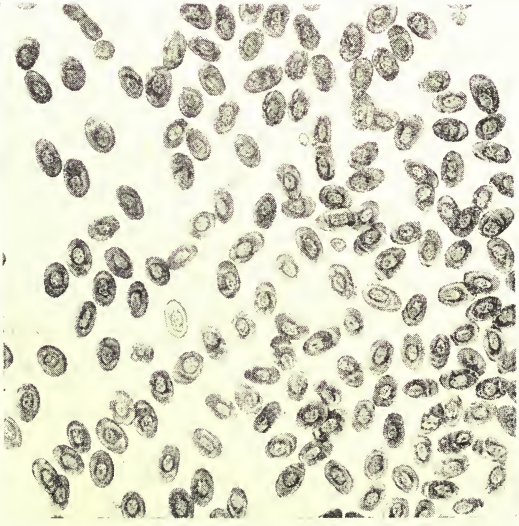
Authority to cut out portions of the exhibits must be first obtained from the magistrate of the place whence the stain is received.—See Form in Appendix IV.

These stains may consist of (1) blood (see p. 171), (2) semen (p. 297), or (3) other matter; such as brain substance, which may be detected microscopically by its anatomical structure.

a



b



a.—Human Blood Corpuscles × 400.

b.—Amphibian Blood Corpuscles × 200.

(From Micro-Photographs by Dr. H. Gibbes.)

[*To face p.* 170.

CHAPTER VI.

BLOOD-STAINS.

[By Lt.-Col. W. D. Sutherland, M.D., I.M.S.]

Appearance.—When a blood-stain comes to be examined, its colour may be anything from blackish through reddish-brown to a dirty grey—very unlike the colour of freshly-shed blood, with which we are all familiar. The colour of the stain depends greatly upon the exposure to light and air that it has undergone. In some cases the efforts of the accused person to get rid of the evidence of his guilt may leave very little trace of the presence of what had been a large blood-stain.

On a hard surface, such as glass or iron, the stain may resemble dark-red wax in parts. If it be the blood of a bird that has caused the stain, the waxy appearance is uniform and highly characteristic. On earth, or plaster, the stain will be dull of surface and dark-brown or greyish-brown in colour.

If the stained fabric be dark in colour, the stains may be hard to detect when examined by daylight. In such a case it is of service to examine the fabric through an eosin-film, as suggested by Popp, or by artificial light, candle-light being the most satisfactory, I think, the rays being allowed to fall obliquely on the fabric.

Often bamboo staves are sent by the Courts for examination, as to the origin of suspicious-looking stains on them. Though the bamboo staff is a very favourite weapon of offence in India, yet it is in only a few cases that the stains on it are found to be due to blood. As a rule they are due to the saliva ejected during the process of betel-chewing, and mimic the appearance of true blood-stains very well indeed; but on further examination of the stain under the microscope their origin is easily enough detected.

I would insist upon the rare occurrence of blood-stains on bamboo staves, although, as we all know, lacerated wounds of the scalp, which at first sight are not unlike cuts made with a

sharp instrument, are common results of blows delivered by means of a bamboo staff.

On the blade of a knife, hatchet, or sword we may often find that what the police have suspected to be blood-stains are really due to rust. On a well-kept knife blood-stains are rarely to be found: in several cases a sacrificial knife has been found free from bloodstains, although it had been in constant ritual use for a long time, and had tracery on its blade, in the crevices of which blood would easily have collected, had it not been kept scrupulously clean. The blood on a knife, if any be present, will generally be found at the junction of the blade with the handle of the knife, or—in the case of a pocket-knife—in the nick in the blade by which it may be raised by the thumb-nail.

Examination of stain.—In order to be in a position to determine whether a suspected blood-stain is really due to blood, we require:—(1) a clean sharp knife; (2) a pair of scissors; (3) some 10 per cent. solution of potassium cyanide; (4) some *yellow* sulphide of ammonium solution;[1] (5) a microscope with a $\frac{1}{2}$ inch, a $\frac{1}{6}$ inch, and a $\frac{1}{12}$ inch oil immersion lens; (6) a Zeiss' modification of Browning's pocket-spectroscope, with—this is indispensable—a wave-length scale.

If the stain be on a hard surface, a portion of it may be moistened with the potassium cyanide solution, scraped off and smeared on a microscopic slide. If it be a soft fabric that is stained, a portion of the stain may be snipped off, immersed in boiling water for three seconds to fix the colouring matter by coagulation, placed on the microscope slide and treated with a drop or two of the potassium cyanide solution, the superfluous fluid being removed at each stage of the process.

To the stains thus treated, there are then applied a few drops of ammonium sulphide solution. The preparation is then covered with a cover-glass, the superfluous fluid is mopped up by a fresh morsel of bibulous paper, and the preparation examined under a low power. If blood be present, at some spot in the preparation we shall see a cherry-red colour. If the coloured part be very small, we bring it into focus under a high power, and then, having removed the eye-piece, insert into the microscope-tube the long tube of the spectroscope. The absorption band or bands visible in the spectrum may now be fixed as to their position on the scale by the simple device of holding a piece of white paper below the end of the short tube of the spectroscope, to illuminate the scale well.

[1] Saturate a 1 : 4 solution of ammonia with hydrogen sulphide and then add an equal volume of ammonia solution, the resultant being $(NH_4)HS$ in solution, which must be kept in a stoppered bottle.

If blood pigment be present, it will have been converted into **cyanhaemochromogen,** whose spectrum gives a dark band at λ570–550 and a darkish band at λ540–525; the latter,

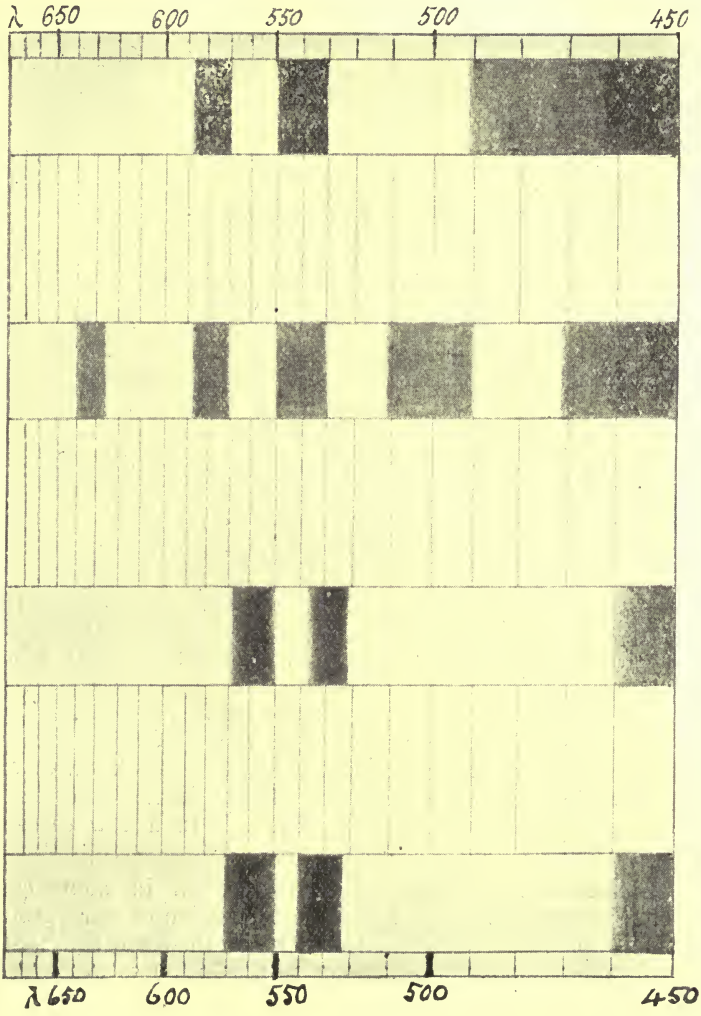


Fig. 13.—The Four useful Spectra of Blood-pigment.

however, if the dilution be high, may be so faint as to be almost or quite invisible.

No other known substance when treated as above described

gives the cherry-red colour *and* the spectrum of cyanhæmochromogen. Hence the value of this method of examination, whose technique has been elaborated by Hankin. The test is a most delicate one and should always be employed. Thus carried out the use of a microspectroscope is obviated, and this is a great advantage, as all who have ever used one will agree. If, as sometimes happens, we have a large stain or a quantity of earth available for the test, then it may be simplified by extracting a considerable portion of the stain with physiological salt solution, and adding to the contents of the test-tube a few drops of pyridin, when the brownish liquid will become cherry-red, and then a few drops of the ammonium sulphide solution. The contents of the test-tube are then examined by the long arm of the spectroscope being held against the tube, and the spectrum of hæmochromogen, which is slightly different from that of cyanhæmochromogen, will be seen, if blood is present.

Were the blood-stains quite fresh—a rare event in Indian forensic medical practice—we should find it hard to get rid of the characteristic spectrum of oxyhæmoglobin: two bands, one at λ587–570 and the other at λ550–530. But in most cases the stains are old enough to yield, on extraction with distilled water or physiological salt solution, the spectrum of oxy- and met-hæmoglobin: four bands, one at λ640–628 in the red, one at λ587–570, one at λ550–530, and the fourth, which is generally merged in the absorption of the blue rays, at λ510–490. Of these spectra the figures are given (Fig. 13)—special attention being directed to the actual position of the absorption bands in the wave-length scale; for it is their position which is all-important.

In my opinion it is sheer waste of time to attempt to obtain the other spectra of blood. The spectra of acid and alkaline hæmatin are the reverse of delicate, and I do not know of any case in which it has been necessary to obtain the spectrum of hæmatoporphyrin here in India, although in a few cases in Europe it has been of use.

Teichmann's crystals.—We may obtain in many cases valuable confirmation—or rather corroboration of our spectroscopic findings by treating a fragment of the stain thus:—On a clean microscope slide a drop of salt solution is evaporated. Near the spot thus formed is placed a minute fragment of the stain. On to the preparation is dropped a drop of glacial acetic acid. The preparation is then covered and warmed in the Bunsen or spirit flame until bubbles appear. It is then laid aside and examined after half an hour. Under the low power of the microscope we shall find a multitude of dark specks, which under the high power will be found to be the various

forms of the crystals of hæmatin chloride. Of these an excellent representation is given in the illustration, which I owe to Major W. H. Dickinson, I.M.S., who drew the illustration from a specimen made in actual practice. The slower the generation of the crystals the more numerous will be their ultimate form—the rhombs, and the larger these will be.

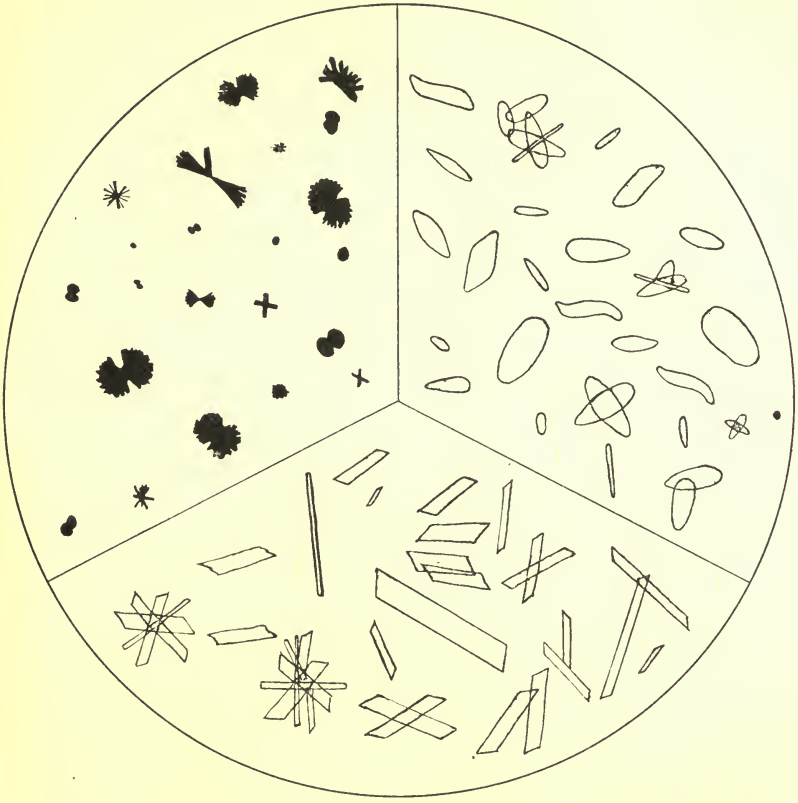


Fig. 14.—Hæmatin Chloride Crystals.

(Drawn by Major W. H. Dickinson, I.M.S., from a specimen obtained in actual practice.)

The preparation must be only gently heated, and the acid must be glacial. But even when these conditions are fulfilled and blood is really present we may fail to obtain the crystals owing to changes having been brought about in the blood by exposure or rust, or both.

As crystals like those of hæmatin chloride may be obtained

from indigo-dyed fabrics, it is well to remember that the crystals of hæmatin chloride will cause frothing of a drop of hydrogen peroxide, whereas the others will not, as was first pointed out by Glaister.

Guaiac test.—I mention another test, not because I use it—my reasons for rejecting it have been detailed elsewhere—but because it was highly praised by Taylor, whose monumental work is looked upon with great reverence by the Bar in India, and it is likely that the medical witness might be asked if he had applied this test, which was discovered by van Deen. All who now use it, with the sole exception of Mita,[1] do not do more than rely on it as a negative test: if they do not obtain the characteristic blue, they conclude that blood is not present. If they do obtain the blue, they do *not* look upon this fact as irrefragable proof that blood is present.

A good way of performing the test is this—a portion of the stain is moistened with distilled water, and then has pressed down on it, with gentle rubbing, a piece of moist white filter-paper. To the brownish stain acquired by the filter-paper are applied (1) a drop of a freshly-prepared straw-coloured tincture of guaiac resin, and then (2) a drop of old oil of turpentine, or hydrogen peroxide. Mita states that if he obtains on adding the guaiac a cherry-red colour, which turns to dark blue within half a minute of the addition of the oil of turpentine, he has satisfactory evidence of the presence of blood. In this opinion he appears, as I have said, to be in a minority of one.

Since the hæmochromogen test is so delicate as to be more useful even as a negative test than the Guaiac test, to perform the latter appears to be a waste of time. If any one doubts this let him try the stains which are known *not* to be due to blood having failed to give the spectroscope of cyanhæmochromogen, and he will find that a large percentage will give the so-called blood-reaction, on which Taylor relied.

Microscopic examination.—Having arrived at the conclusion that the stain before us is really due to blood, we proceed to determine whether this has come from a mammal or a non-mammal thus:—A minute fragment of the stain is left to soak in two drops of Vibert's fluid—½ gramme mercuric chloride and 2 grammes of common salt in 100 c.c. of distilled water—for half an hour. It is then teased out and examined. Under the low power one of the yellowish-red masses, due to agglomeration of erythrocytes, is brought into the centre of the field. The more or less amorphous débris, and the fibres of

[1] Gross' *Archiv.* 1909, 35, 361.

the material stained do not interest us. Under the high power the mass will reveal the erythrocytes, of which it is composed, and at its periphery the general shape of these can usually be fixed, as also the presence or absence of nuclei. Near the edge of the mass may often be found a group of four or five erythrocytes, and with luck one may find a solitary erythrocyte.

If bird's or fish's blood be present we shall rarely find the erythrocytes entire. In the great majority of cases all that we shall see will be a mass of granular elliptical nuclei. These must be carefully examined in order to determine that they are nuclei and not misshapen circular erythrocytes that have undergone granular degeneration. If we find elliptical erythrocytes with elliptical nuclei the diagnosis of non-mammalian blood is very easy; but such cases are unfortunately not common.

If mammalian blood be present we shall find circular erythrocytes more or less altered in shape, and perhaps granular. But nuclei will be very rarely present, for it is only very few *very young* mammalian erythrocytes that are nucleated, and it is very rarely that one of these is seen amidst the thousands of

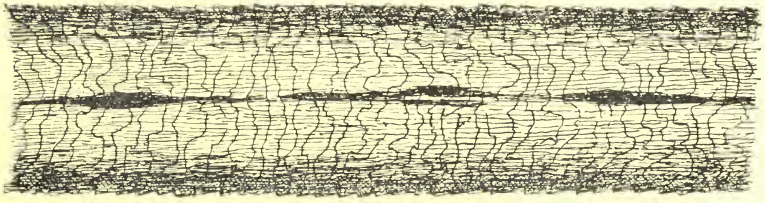


FIG. 15.—Human Hair.

(By W. H. Dickinson.)

Light brown hair from head. The darker the hair, the greater the amount of pigment, and the less structure seen.

non-nucleated corpuscles that are found in a single preparation. The erythrocytes of the camel are elliptical, and *might* be mistaken for the nuclei of non-mammalian erythrocytes; but here the biochemical test would clear up the difficulty, if any.

Only practice will enable the observer to come to a decision after examining one or two blood-masses under the oil-immersion lens. The beautifully marked differences seen in fresh preparations of mammalian and non-mammalian blood are not present in preparations made from old blood-stains.

I do not think that one gains much by using a micrometer —stage- or eye-piece. It is not the size of the erythrocytes seen that matters so much as their general shape and the

presence or absence of nuclei. It is quite useless to attempt to determine by means of micrometry, the origin of mammalian erythrocytes. Even in the case of fresh blood the determination is not sufficiently accurate to be of much use in forensic medicine. The coefficient of drying of erythrocytes has not yet been, nor is it likely to be, determined; still less the degree of return to their original size as the result of treatment with any of the various fluids that have been devised for treating preparations of blood-stains. Thus we can never be certain that the erythrocytes from a stain have regained their exact size when fresh, neither more nor less. Reference to any table—or

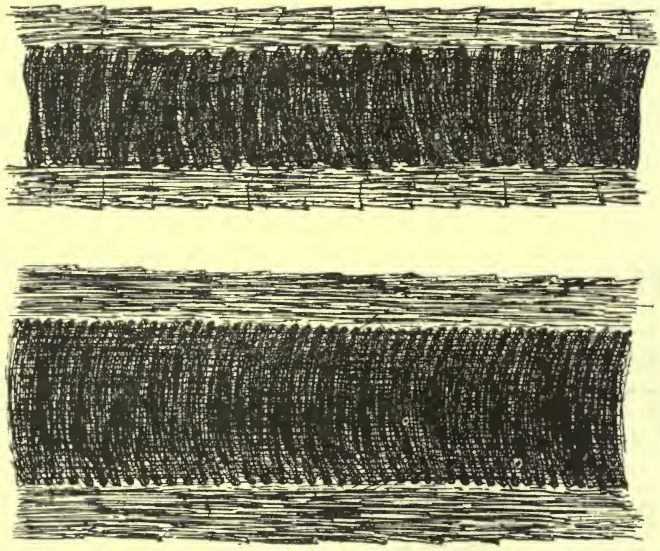


FIG. 16.—Cat's Hair.
(By W. H. Dickinson.)

to my monograph—will show that even in the case of fresh blood the erythrocytes of various species of mammals differ very little from those of man, and that this is true only of average specimens: the individual specimens of any one species may differ more in size from each other than the average specimens of that species from the average specimens of another species.

At the end of this chapter I have collected a few cases, which illustrate the aid given by the microscope in Indian forensic medicine.

In some cases we shall find hairs in the stain, and these

may be of service to us. The determination of the source of a hair is not easy, but Major Dickinson, who has made a special study of hairs, has kindly drawn several from nature. Micro-photography would not have brought out the characteristics of each type so clearly as do these admirable drawings, for which I am deeply indebted to him.

Biochemical tests.—These are of recent growth, but are none the less trustworthy, and by them we are enabled to determine the origin of a blood-stain with accuracy.

The Precipitin test can always be carried out here in Calcutta in a well-equipped laboratory by a skilled observer. In order to understand it we must remember that the living organism has the power of manufacturing antibodies for any albuminous material that may be introduced into it. These antibodies exist in the blood of the animal that has been treated, and the blood or its watery portion—the serum—can be stored for use. If we take a dilute solution of the albuminous material in question and to this very carefully add a few drops of the serum of the animal that has been treated with it we shall find a reaction take place: at the point of contact of the animal's serum with the albuminous solution there will come into being a cloudy layer. This is due to the precipitation of the albuminous particles by the precipitins contained in the treated animal's serum. The reaction will not occur if the serum be added to a solution of an albuminous material other than that with which the animal was treated. In other words, the reaction is a specific one. It is also a very delicate one, for even if the solution of albuminous material be of only one part in a thousand it will readily become evident.

For forensic medical practice the observer must have at hand the serum of animals—fowls are as good as any—that have been treated each with the blood of one of the domestic animals—dog, cat, horse, buffalo, pig—and a large quantity of the serum of fowls treated with the blood of man. For *the* question which he will have to answer is: Is this stain due to human blood?

From the domestic animals the blood is obtained by venesection; in the case of man it is most conveniently obtained from the placenta, after the umbilical cord has been cut. The blood is collected with great care, to avoid all chance of contamination, and kept in sterile flasks in which it is allowed to clot. As the clot shrinks the serum exudes, and next day this is decanted and heated to 56° C. for half an hour. It is then stored in sterile phials, corked and sealed with paraffin, which are kept in the freezing chamber until they are needed.

The fowl's wing is carefully purified on the inner surface by being swabbed with pledgets of cotton-wool soaked in ether —and then the serum (thawed and brought up to 37° C. or a little higher) is injected into the wing vein. The dose is

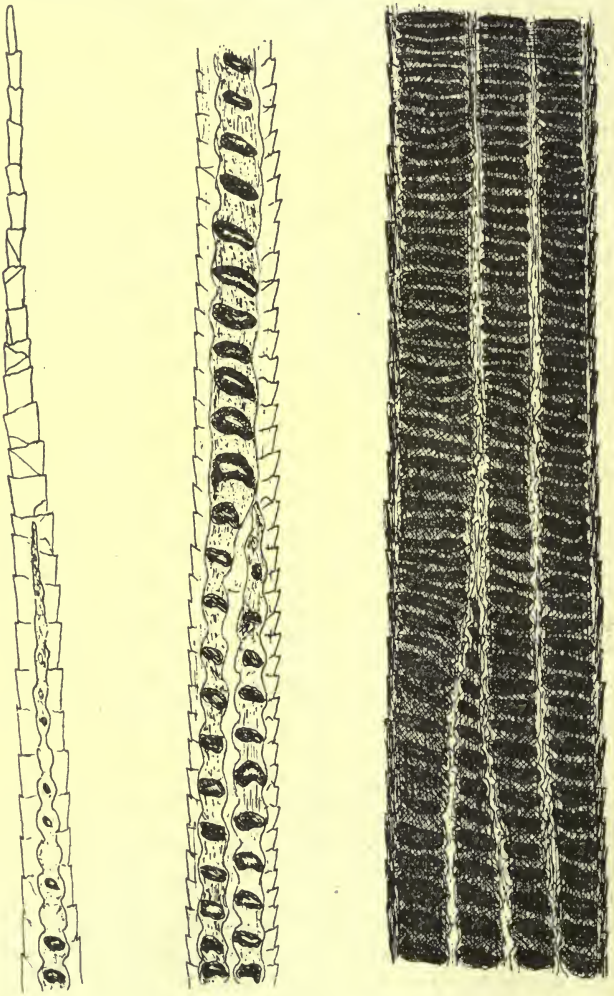


FIG. 17.—Rabbit's Hair.
(By W. H. Dickinson.)

usually 4 c.c. On the fourth day a second injection is made, the other wing being used. Fourteen days after the second injection the fowl is bled. Its blood is collected as above

described, and next day the serum is tested as to its precipitating power and specific action thus:—

The sera of the domestic animals and of man are diluted a thousandfold with physiological salt solution. In a stand are placed six taper tubes—and into these are put the 1:1000 dilutions of serum, the last tube receiving only salt solution. Then each tube has its contents allowed to run nearly out of it, to wet its inner surface well. It is then held in a slanting position, and down its side are allowed to run two drops of the treated fowl's serum—which may conveniently be called the antiserum.

Supposing that the fowl had been treated with human serum, then if the antiserum derived from it be specific and highly potent we shall within three minutes observe a marked reaction in the tube containing the 1:1000 dilution of human serum, but in no other tube will any reaction be visible even after the lapse of twenty minutes. This antiserum is stored for use, and every time that it is used for testing blood-stains its specificity and high potency are tested again, in the way above described, so that the observer may be sure at the time of testing the blood-stains that his antiserum fulfils the desiderata of the forensic test: for sometimes potency and specificity become altered by keeping. The accompanying plate shows the reaction in one tube and its absence in all the others.

The number of treated fowls that yield a good antiserum is fairly large—over 50 per cent. Many are refractory, and many yield a serum that is weak, and therefore useless for medico-legal work.

When the observer desires to determine the origin of a blood-stain he makes an extract of it, by soaking the stained fabric or scrapings of the stain in physiological salt solution. Some stains are hard to extract, and for these the addition of a few drops of solution of potassium cyanide to the salt solution in which they are immersed is a good plan. The stain extract is then tested as to its alkalinity or acidity. If it be acid it must be rendered neutral or slightly alkaline by the addition of a drop or two of a weak solution of caustic soda, or potassium cyanide. If it be strongly alkaline, as it will be if the cyanide solution has been used to hasten extraction, it must be rendered only slightly alkaline by the addition of a drop or two of a solution of tartaric acid.

The extract having been thus treated is diluted with salt solution until it corresponds to a 1:1000 dilution of serum. The guide is the amount and persistence of the froth formed on gentle shaking. A little practice enables the observer to

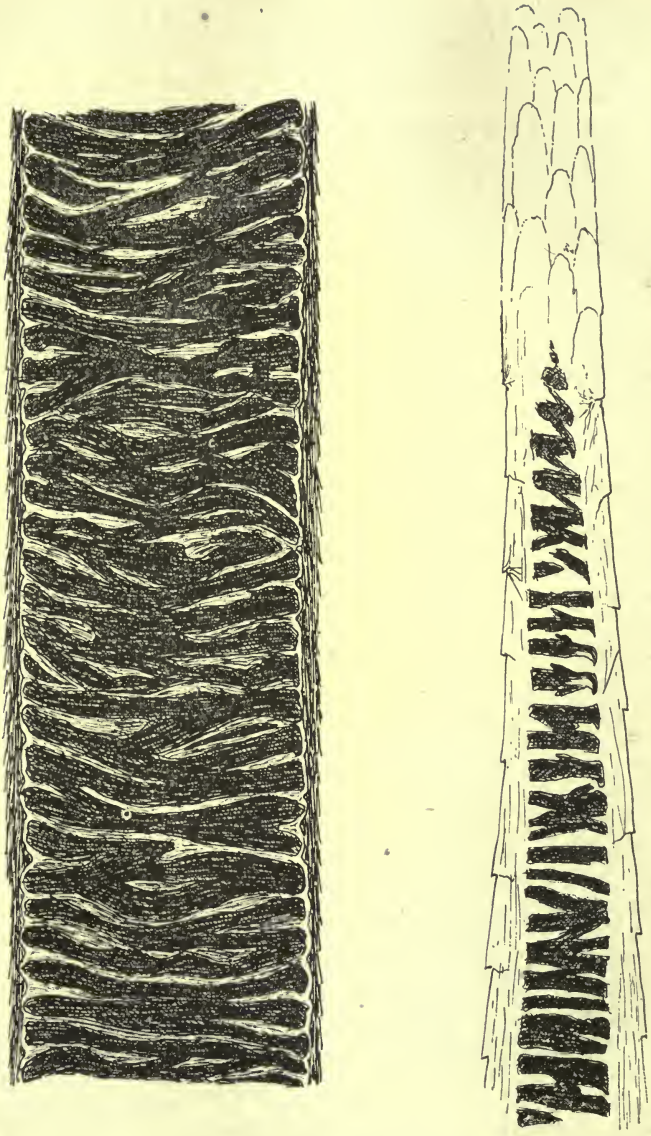


FIG. 18.—Guinea-pig's Hair.

(By W. H. Dickinson.)

obtain the necessary dilution of the extract with surprising accuracy. The dilution is carried out in order that the test

may be as delicate as possible. If anti-human serum be added to, say, pure horse serum or a 10-fold dilution thereof we shall have a reaction—the mammalian reaction, as Nuttall first called it—but if the horse serum be diluted to 1 : 500 no such reaction will occur within 20 minutes—and it is still less likely to occur if the dilution be 1 : 1000.

Dilute, water-clear[1] extracts of all the stains that have been proved to be due to blood having been made, these are set out in taper-tubes. To the contents of each tube the observer adds two drops of an anti-human serum, which he has already tested on the morning of that day, and found to be highly-potent and specific in reaction. When testing it, he has guarded against too rapid thawing, which interferes very much with the specificity of reaction, for the physical attributes of the serum are obtained in their entirety only by very slow thawing. The tubes whose contents show reaction within twenty minutes are noted. The stains whose extracts are in these tubes are proved to be due to human blood. *Monkey's* blood has been only once alleged to have caused the stains found on articles examined by me; but, as I have shown elsewhere,[2] even those apes that are most nearly related to man are sufficiently far removed from man for their blood to be differentiated from his by the 20 minutes' time-limit of the reaction. Other portions of the extracts which have shown no reaction with the anti-human serum are now tested with an anti-ruminant serum. Should any stain-extract still show no reaction, a fresh portion of it is tested with anti-canine, anti-equine, etc., serum until the whole gamut of the domestic animals has been gone through. Of course, should the police have reported that it is suspected that the blood of, say, a cat has been smeared on the articles sent for examination, the anti-feline serum is the first that is used after the anti-human serum. I may note that in those cases in which the police had reason to suspect that what was alleged to be human blood had an origin other than human, their suspicion was generally found to be well-grounded. The wiles of those who desire to get their enemies punished, or to escape from the consequences of their own acts, are many, but the police seem to be quite able to cope with them. From the large amount of material that has passed through my hands, I am convinced that the work of the police in grave criminal cases is far more honest

[1] The extracts will not be quite clear in the case of blood-stained earths, and in some cases the dilution is much higher than 1 : 1000, because the quantity of albuminous material in the stain is so minute.

[2] SUTHERLAND: "The Applicability to Medico-legal Practice in India of the Biochemical Tests for the Origin of Blood-stains." Calcutta, 1910. (*Scientific Memoirs*. New Series. No. 39.)

than certain of the lower organs of the press here care to admit. Why I am so convinced will be clear to all unprejudiced readers of the details of the examination of articles given below.

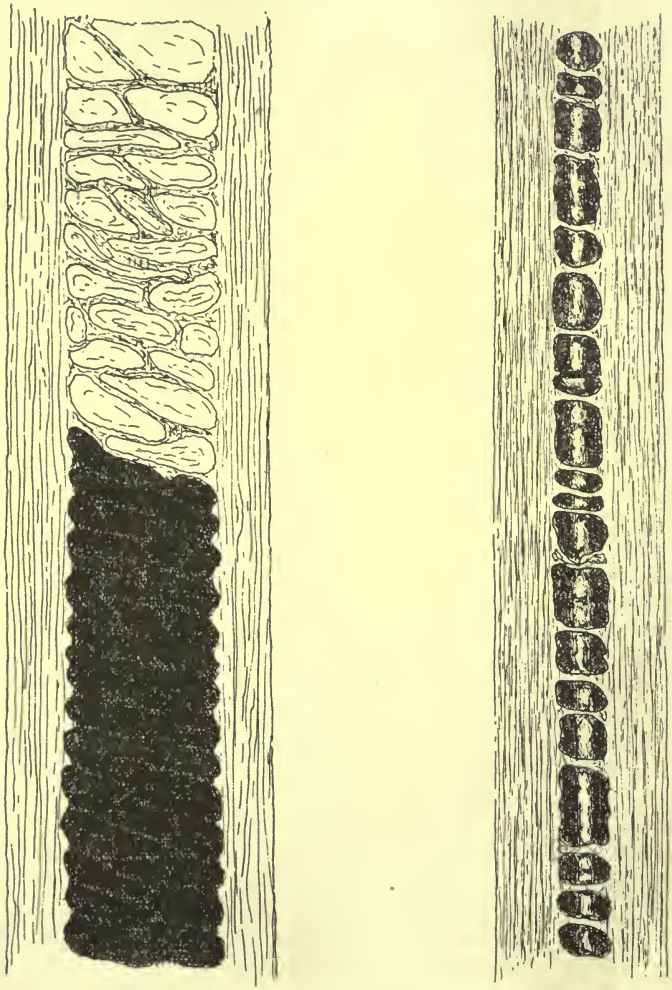


FIG. 19.—Dog's Hair; Irish Terrier.
(By W. H. Dickinson.)

If a blood-stain has been washed it will usually be impossible to say more than that it is due to mammalian or non-mammalian blood. If it has been well washed all that can be said is that it is due to blood, whose elements are too

disintegrated for its source to be determined. Failure to obtain a reaction with the extract of a blood-stain may be due to any of the following causes: (*a*) The extract when diluted to the 1:1000 standard may be incapable of reacting with the anti-serum, owing to the paucity of albuminous material that is present. Such a result *may* occur in the case of microscopically visible stains; but, in my experience, does not occur where the stain is plainly visible to the naked eye, and has not been interfered with by any of the substances noted hereunder. (*b*) The extract, if markedly acid, will not react until it has been rendered nearly neutral. (*c*) If mercuric chloride be present, one part in 10,000, or permanganate of potassium be present in even smaller amount, the reaction will not occur. (*d*) Chloride of lime, sulphate of copper, sulphate of iron, chloride of zinc and bisulphide of sodium have all an adverse influence on the reaction. Fortunately none of these compounds is commonly met with in forensic medical practice here; but the observer must bear in mind that any of them may be present, and interfere with the reaction. Naturally, if a stain-extract, that froths when diluted to 1:1000, and is neutral or slightly alkaline, fails to react with the anti-human serum, it is no use asserting that it is thereby "not proved to be due to human blood," or assuming that it is contaminated by any of the above-mentioned compounds, if it gives a reaction with, say, anti-ovine serum, showing thereby that the physical characters of its elements have not been interfered with; or *vice versâ*. Putrefaction of the stains does *not* influence the reaction. This is fortunate, for sometimes blood-soaked garments are so carelessly packed that, before it dries, the blood undergoes a marked change. The age of the stain does not matter. I have obtained the characteristic reaction from extracts of stains that had lain in Calcutta for over four years, and it is not likely that stains of greater age than this would fall to be examined.

Here in India one is frequently called upon to examine earth that has been dug up from the floor of a dwelling, or from a courtyard, or a field, with a view to ascertain whether the stains on it are due to human blood. Having determined that blood is present, the observer might be at a loss to discover its source, owing to the fact that his best endeavours to obtain a clear extract fail miserably. The diluted extract remains turbid on account of the particles of clay or humus that remain in suspension, in spite of repeated filtration and centrifugalization.

With such an extract the test, if carried out in the ordinary way by daylight—by inspection of the contents of the tube

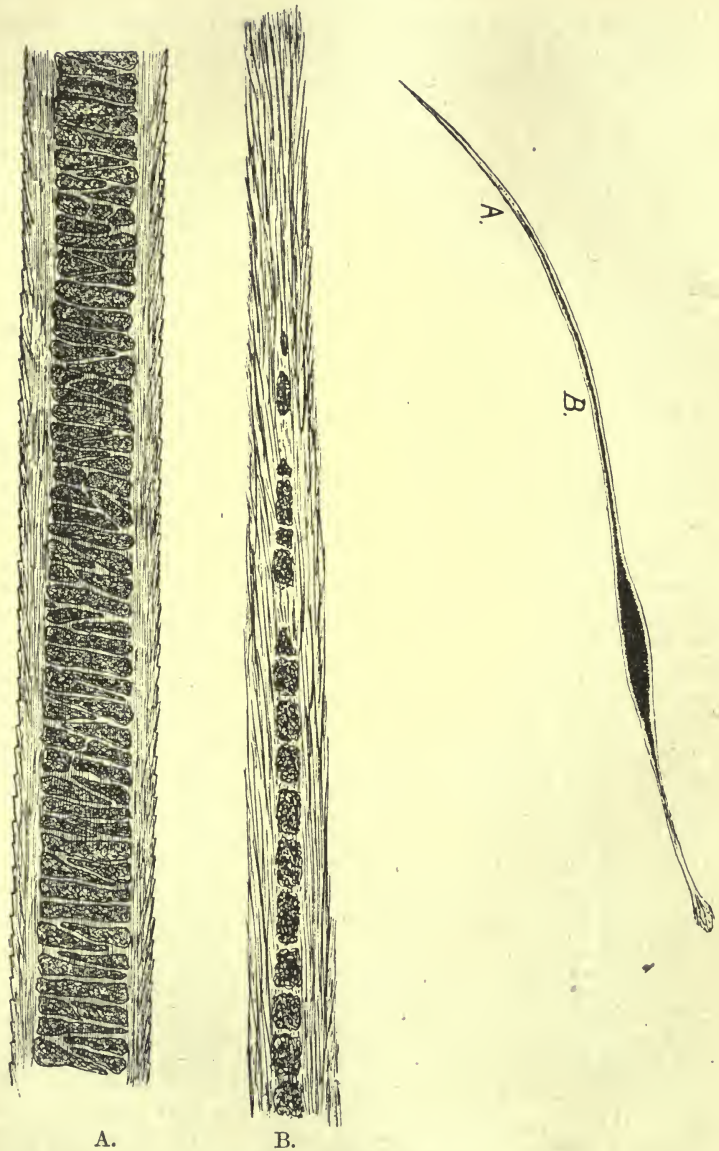


FIG. 20.—Indian Ox Hair.
(By W. H. Dickinson.)

against a black background against the light—reveals nothing: the turbidity masks the layer of reaction, if it exists. This

difficulty may, I find, be surmounted by a very easy manœuvre. Instead of viewing the tube-contents against the light, they should be viewed against the black background held nearly *at right angles* to the light. When so viewed the turbidity of the extract-dilution, which was so marked when this was viewed against the light, will be found to have disappeared, while the layer of reaction, if present, remains clearly visible.

If we add anti-goat serum to dilute extracts of stains caused by ox, buffalo, goat or sheep bloods, all will react in a greater or less degree: for the ruminants are very closely akin. In order to determine which ruminant is the source of the blood in any case, we must test separate portions of the stain-extract with anti-goat, anti-sheep, anti-ox, and anti-buffalo sera. The anti-serum which gives the greatest and most rapid reaction will guide us in such a case.

The use of fowls as the source of the various precipitating anti-sera is of great service in India, where rabbits, which are commonly used in Europe, are hard to obtain. The fowls must be carefully isolated for ten days after purchase to exclude those infected with *pasteurella*. Here in Calcutta the Chittagong breed of fowls is to be preferred, as the birds are much larger than those obtainable in Northern India.

The complement-fixation test.—Although this test cannot be carried out satisfactorily in general forensic serological work in India, owing to the large amount of time which one has to spend in doing it, it merits mention, which will be as brief as is consistent with intelligibility. The test is based upon the fact that when an animal receives injections of the washed erythrocytes of another species, its serum in time develops the power of causing the erythrocytes of that other species to become rapidly dissolved if they are brought into contact with the serum in a test-tube.

If we treat a rabbit by means of injections of washed sheep's erythrocytes, made into the ear-vein, and repeated twice at three days' intervals, its serum, if taken on the fourteenth day after the last injection, will be found rapidly to dissolve sheep's erythrocytes but not the erythrocytes of other animals. This treated rabbit's serum contains two elements that are of importance: (1) the complement, and (2) the antibody for sheep's erythrocytes. These must act *in concert* in order that the erythrocytes may be dissolved. If the serum be heated to 56° C. for half an hour, its complement is destroyed and the dissolving power is lost. If, however, to the heated serum be added some fresh rabbit serum or fresh guinea-pig serum, the complement is restored and the dissolving power returns, for

the antibody is not affected by the heat which destroyed the complement.

Thus if we put into a test-tube some fresh guinea-pig's serum (complement), some heated serum of a treated rabbit (antibody) and some sheep's erythrocytes in suspension in physiological salt solution, the dissolution of the erythrocytes will be speedily brought about, their pigment passing out into the fluid.

If we take complement and incubate it for an hour at blood-heat with an extract of a blood-stain, and then add to the contents of the tube the antibody and the sheep's erythrocyte-suspension, we shall have dissolution of the erythrocytes as before. But if we take complement, and the blood-stain extract, *and some antiserum for the blood that caused the stain*, on incubating these we shall have the antiserum combining with the albuminous elements of the extract. This combination has the property of fixing the complement, so that none is left over to act in concert with the antibody of the treated rabbit's serum when this is added, and consequently when the erythrocytes are added they are not dissolved.

Thus we see that if we have incubated together for an hour (1) complement with (2) the extract of a blood-stain and (3) some anti-human serum and then on adding (4) some heated serum of a rabbit that has been treated with sheep's erythrocytes, and (5) a suspension of sheep's erythrocytes, we obtain dissolution of the erythrocytes, we may be sure that no combination of the albuminous elements of the stain-extract with the anti-human serum has taken place. In other words, we have proof that the stain is not of human blood. If dissolution of the erythrocytes does not occur, this shows that the complement had become fixed before the antibody was added, *i.e.* that the anti-human serum had combined with the elements of the stain-extract, because these are of human origin.

In actual practice the treated rabbit's serum after it has been heated has its power of causing the complete dissolution of 1 c.c. of a 5 per cent. suspension of sheep's erythrocytes in physiological solution estimated: the smallest quantity of the serum that is required for this is noted, and holds good so long as the supply of that particular rabbit's serum lasts. The smallest quantity of the anti-human serum—or anti-equine, etc., serum—which will cause fixation of the complement in the presence of $\frac{1}{100000}$ c.c. of human serum (or equine, etc., serum as the case may be) is determined, and holds good so long as the supply of that particular anti-serum lasts. The requisite amount of the complement must be ascertained on the morning of the day when the test is carried out.

Altogether a tedious task, which, even after all requisite quantities have been determined, takes at least four hours to perform. Another drawback is the fact that many materials which may have blood-stains on them have, when extracted, an anti-complementary action. This is not removed by boiling, whereas the specific action of the stain-extract is destroyed by boiling. Therefore two series of tubes are needed. In one series are put boiled, in the other unboiled, extracts of the stained materials, and into all are put the necessary elements of the test, the results obtained in the two series being then compared.

Here in India the great difficulty in the way of the observer is the fact that it is exceedingly hard to obtain the very strong anti-serum required to cause complement-fixation in the presence of the minute amount of albuminous material in the very high dilution of the stain extract that is used in practice. The higher the dilution the more delicate the test, because the more specific, and thus the more trustworthy the results obtained by it.

Even were one able to carry out this test here as it is performed in Europe, it would give us only information corroborative, never corrective, of that obtained by the precipitin test. And, as already mentioned, it requires so much time that it cannot be carried out satisfactorily in general work. The day having only 24 hours, of which a certain amount must be consumed in sleep, it is never likely to come into general use in India, we think.

The anaphylaxis test.—This test I have not yet had occasion to employ, but describe it, as it may later be found possible to have recourse to it in those cases in which the results obtained by means of the precipitin test seem to call for corroboration.

It is based upon the fact that when an animal—preferably the guinea-pig, which is very sensitive—receives an injection into its circulation or under its skin of some foreign albumin it develops extraordinary hypersensitiveness to this albumin, so much so that if the first injection be of $\frac{1}{100}$ c.c. of sheep's serum, and the second dose be $\frac{1}{2000000}$ c.c. the body temperature will rise and continue to rise for about an hour, whereas a previously untreated guinea-pig requires $\frac{1}{20}$ c.c. of sheep's serum in order that its body temperature may rise as shown by Friedberger.

The shock caused by larger doses of foreign albumin is much greater in sensitized guinea-pigs. An untreated guinea-pig's temperature will fall if it receives 1 c.c. of sheep's serum

intraperitoneally; a guinea-pig that has already received $\frac{1}{100}$ c.c. will show a marked fall of temperature if the second dose be only $\frac{1}{100000}$ c.c. given intraperitoneally.

The hypersensitiveness comes into being only after a certain time has elapsed since the first dose of sensitizing albumin was given. Conveniently the fourteenth day may be taken for the second dose in medico-legal work, the test being carried out thus:—

A series of guinea-pigs—say six—is treated by means of injections of $\frac{1}{100}$ c.c. of human, bovine, feline, equine, etc., serum given intraperitoneally or subcutaneously. On the fourteenth day this series is ready for the test. An extract of the suspected stain is then made with physiological salt solution. The guinea-pigs' body temperature is taken, by a special thermometer being introduced into the rectum, and noted. Then each animal receives an intraperitoneal injection of a portion of the stain extract, which has been divided into seven parts. The seventh part is given to an untreated guinea-pig, which acts as a further control.

Now, supposing that our stain is due to human blood we shall have—

		Result.
1.	G.P. sensitized with horse serum . .	nil.
2.	„ „ „ sheep serum . .	„
3.	„ „ „ dog serum . .	„
4.	„ „ „ cat serum . . .	„
5.	„ „ „ pig serum . . .	„
6.	„ „ „ human serum .	body temperature shows marked change.
7.	„ not previously treated	nil.

The change in the body temperature will depend on the quantity of human albumin that was given by the second injection. If this was but small the temperature will show a rise; if the quantity was large there will be a distinct fall.

As will be seen, this test is wasteful of guinea-pigs; for the first animal of our series will now be hypersensitive to equine and to human albumin, the second to ovine and human albumin, and so on. Still there *might* arise a case in which the information afforded by the test would be of value.

Naturally the question of the identity of the blood in a stain with that of a suspected person is one that has arisen in medico-legal cases. Many observers have endeavoured to find

the answer to this question; amongst these are Landsteiner and Richter,[1] and von Dungern and Hirschfeld.[2] They have found that the bloods of all the individuals that they examined fall into four groups, which they call A, B, AB, and O.

A.—The erythrocytes contain an agglutinable substance A, and the serum an isoagglutinin β. This class is very numerous in Central Europe.

B.—The erythrocytes contain an agglutinable substance B, and the serum an isoagglutinin α. This class is comparatively rare in Central Europe.

AB.—The erythrocytes contain agglutinable substances A and B, but the serum contains no isoagglutinins.

O.—The erythrocytes contain no agglutinable substance, but the serum contains isoagglutinis α and β.

Lattes and others call the groups Aβ, Bα, ABo, $\alpha\beta$O.

Von Dungern and Hirschfeld[3] found that A is much more common amongst Europeans than amongst Indians, who have a higher percentage of B than Europeans, Negroes and Annamites. They go so far as to assume that Northern and Central Europe is the cradle of the A race, while India is that of the B race.

The investigation is conveniently carried out by means of hanging-drop preparations. The erythrocytes to be examined are suspended in isotonic saline solution, and to this a small quantity of the serum, whose properties are being investigated, is added. In practice 1 part of erythrocyte-suspension (1·2 or 2·3), and 2 parts of a 1·2 dilution of serum are employed. Care must be taken to distinguish between pseudo-agglutination and real agglutination, in which irregular masses of erythrocytes are formed, the cells being piled one on the other and their contours lost. So far we have had no occasion to apply this test, whose technique we are practising against the day when it may be required. Here the long distance of most districts from Calcutta may be a serious objection, not only as affecting the suspected individual, but as causing unavoidable delay in examining the blood in the stains, whose elements are subjected to many known and possibly some unknown influences which may affect the results.

Magistrates in this country are eager enough to know everything about stains that are in question in cases before them. We have been asked to furnish information as to whether the blood in stains had been shed by a woman or a man; whether it had been shed before, during, or after the birth of a child; from what part of the body it had come; what the probable

[1] *Zschr. f. med. Beamte*, 1903, p. 85.
[2] *Muenchener med. Woch.*, 1910, p. 741.
[3] *Lancet*, 1919, ii. 675.

age of the person was; also whether a stain had been caused by male or female semen.

Lattes[1] reports a case in which a man was accused by his wife of having been unfaithful. She had found bloodstains on the front of his shirt, and had consulted a clairvoyante, who had confirmed her suspicions.

The man said the source of the blood might be—

(*a*) Some beef that he had handled just before he had micturated.

(*b*) Blood from his urethra, as he had suffered from difficulty in urination for some time.

(*c*) The shirt might have been handled by a neighbour, while she was menstruous.

(*d*) He considered it to be most probable that the blood was his wife's, and that she had stained the shirt with it in order to force him to confess.

As the stain-extracts reacted only with anti-human precipitating serum, bovine blood was excluded, and Lattes proceeded to examine the properties of the extract against the erythrocytes of certain persons. He found that it agglutinated the erythrocytes of two persons known to belong to group B, and caused no agglutination of those of two persons known to belong to group A.

Then he tested the erythrocytes of the man, the wife and the neighbour who was suspected to be the man's paramour. The man and this woman belonged to group A, while the wife belonged to group O, and was therefore excluded as the source of the blood. As there were no vaginal epithelial cells in the stains, Lattes was of opinion that the neighbour could be excluded too, and that the stains had probably been caused by the man's blood, so peace was restored.

[1] *Archivio di antrop. crim. e med. legale*, 1916, 38, 400

DETAILS OF FINDINGS AS TO 28,693 ARTICLES, SUSPECTED TO BE BLOOD-STAINED, EXAMINED IN 10,5000 MEDICO-LEGAL CASES.

Articles.	Total.	Blood-stained.	Source of blood.			
			Non-mammalian.	Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human	
Adze	53	26	—	22	S. G. 1	—
Amulets	2	—	—	—	—	—
Anal discharge ..	1	—	—	—	—	—
Apparel, wearing ..	15,144	11,048	46	9761	S. G. 155 Camel 1 O. B. 57 Dog 1 S. G. & H. 8 O. B. & H. 2 Rat 1 G. & H. 2	—
		Human also 1. Horse.				
Areca nut	1	—	—	—	—	—
Arrow	35	29	—	20	S. G. 1	1
Ashes	15	7	—	5	—	1
Awl	9	6	—	5	—	—
Axe	945	476	11	374	S. G. 17 O. B. 5 S. G. & H. 1	14
Bag	14	12	2	10	—	—
Bamboo	911	496	2	394	O. B. 4 S. G. 11	2
Bark	21	12	—	8	S. G. 2	—
Barrel	3	3	—	3	—	—
Basket	27	22	—	19	S. G. 2	—
Bayonet	2	1	—	1	—	—
Beads	28	25	—	21	—	—
Bedding	829	591	2	465	S. G. 1	—
Belt	6	4	—	4	—	3
Bench	2	1	—	1	—	—
Bill-hook	555	341	2	304	O. B. 3 S. G. 2	1
Blood	28	—	—	21	Dog 1 O. B. 1	—
Bone	33	15	—	20	Dog 1 O. B. 2 S. G. 6	—
Book	4	3	—	3	—	—
Bottle	8	6	—	5	—	—
Bow	1	—	—	—	—	—
Bowl	1	1	—	1	—	—
Bracket	3	2	—	1	—	—

Articles.	Total.	Blood-stained.	Source of blood.			
			Non-mammalian.	Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Bradawl	1	1	—	1	—	—
Bread	2	2	—	2	—	—
Brick, tile	119	77	1	69	O. B. 1 S. G. 2	—
Broom	10	6	—	6	—	—
Bucket	2	1	—	1	—	—
Buttons	4	2	—	2	—	—
Can, canister ..	8	6	—	6	—	—
Cane	1	1	—	1	—	—
Canvas	3	3	—	3	—	—
Cardboard	3	2	—	2	—	—
Cart	14	4	—	2	O. B. 2	—
Celluloid, sheet of ..	1	1	—	1	—	—
Cement, plaster ..	102	69	—	52	S. G. 5 O. B. 1	—
Chair	1	1	—	1	—	—
,, leg	1	1	—	1	—	—
,, rail	1	1	—	1	—	—
Chain	1	1	—	1	—	—
Chisel	20	8	—	7	—	1
Chopper, straw ..	381	274	—	253	S. G. 2 O. B. 1	—
,, meat ..	10	10	—	10	—	—
,, shell ..	1	—	—	—	—	—
Cigarettes	3	—	—	—	—	—
Coconut-scraper ..	2	2	—	2	—	—
,, shell ..	1	1	—	1	—	—
Coins	19	8	—	6	—	—
Coir	3	3	—	2	S. G. 1	—
Convict's neck ticket	1	1	—	1	—	—
Cordage	137	93	—	85	O. B. 1 S. G. 3 Horse 1	2
Cot	80	54	—	49	S. G. 1	—
Cotton wool	23	16	—	15	S. G. 1	—
Cowdung	13	10	—	7	—	—
Crowbar	21	12	—	12	—	—
Curtain	9	5	—	5	—	—
Cushion	1	1	—	1	—	—
Cutter, areca nut ..	3	3	—	3	—	—
,, fish	29	20	—	17	—	—
,, grass	3	1	—	1	—	—
,, leather ..	1	1	—	1	—	—
,, vegetable ..	19	12	—	10	O. B. 1	—
,, wire	4	3	—	3	—	—
Dagger	112	94	—	75	S. G. 3 O. B. 1	—
,, scabbard ..	8	6	—	6	—	—
Dibble	8	6	—	5	—	—
Dirt from finger nail	1	1	—	1	—	—
Door-panel	10	4	—	4	—	—

Articles.	Total.	Blood-stained.	Source of blood.			
			Non-mammalian.	Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Door-frame	2	1	—	1	—	—
Earth	2509	1757	30	1481	O. B. 20 O. B. & H. 1 S. G. 58 Cat 2 Dog 1 Pig 1	21
				Human also 1.		
Envelope	1	1	—	1	—	—
Fan	2	2	—	2	—	—
Fæces of tiger (supposed)	1	—	—	—	—	—
Farm implements ..	43	20	1	17	O. B. 2	—
Feather	3	3	—	1	—	—
				Human also 1.		
Fibre, aloe	3	1	—	1	—	—
File	2	1	—	1	—	—
Flesh	23	4	—	10	O. B. 4 Horse 3 Goat 1	—
				Human flesh.		
Flesh, cooked ..	3	—	—	—	O. B. 1	—
Fluid	12	7	—	3	S. G. 1	—
Flour	1	1	—	1	—	—
Fork	1	—	—	—	—	—
Fruit	2	1	—	1	—	—
Game board	1	1	—	1	—	—
Glass, pane	8	6	—	5	—	—
Glove	1	1	—	1	—	—
Gourd	2	1	—	—	—	—
Grain	2	2	—	2	—	—
Hair, not adherent to weapon	83	53	—	70	Horse hair 1 Insect 2 Cat 1 Vegetable fibre 1	—
Hair pin	1	—	—	—	—	—
,, tuft of Hindu ..	2	2	—	2	—	—
Halbert	25	16	—	10	S. G. 2	—
Hammer, mallet ..	26	19	—	15	—	—
Harness	11	5	—	4	O. B. 1	—
Hat, turban, cap ..	518	385	1	351	S. G. 2 O. B. 2	1
Haversack	2	—	—	—	—	—
Hinge	1	1	—	1	—	—
Hoe	6	5	—	5	—	—
Holdall	2	1	—	1	—	—
Hook	2	—	—	—	—	—
Husk	1	—	—	—	—	—
Iron, bar	16	10	—	9	—	—
,, fragment ..	2	2	—	1	—	—
,, hook	2	—	—	—	—	—
Idol, pole used as ..	1	—	—	—	—	—

Articles.	Total.	Blood-stained.	Non-mammalian.	Source of blood.		
				Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Jewellery	281	220	—	195	—	2
Jute	2	1	—	1	—	—
Key	5	3	—	3	—	—
Kitchen utensils ..	19	13	—	11	—	—
Knife	681	494	7	396	S. G. 13 O. B. 8	1
,, sheath	18	11	—	10	—	—
,, sacrificial ..	24	3	—	3	—	—
Kukri	21	11	1	8	O. B. 1	—
,, sheath	6	2	1	1	—	—
Lacquer box	1	1	—	1	—	—
Ladder	2	1	—	1	—	—
Lamp, lantern ..	7	4	—	4	—	—
,, stand	1	1	—	1	—	—
Latch, wooden ..	3	3	—	3	—	—
Leather	1	1	—	1	—	—
Leaves	246	191	2	167	S. G. 2	—
		Mammalian also 1.				
Letter	1	1	—	1	—	—
Lime	1	1	—	1	—	—
Lint	2	2	—	2	—	—
Match	2	2	—	2	—	—
,, box	5	5	—	5	—	—
Material from stained body of accused	1	—	—	—	—	—
Mattings, carpet ..	259	201	16	178	S. G. 6	3
Micro-slide	1	—	—	—	—	—
Mill hand	1	1	—	1	—	—
Money order acknowledgement	1	1	—	—	—	—
Nail-parings	159	14	—	14	—	—
,, iron	1	1	—	—	—	—
Nuts	4	4	—	4	—	—
Oil cloth	4	4	—	4	—	—
Oar	1	1	—	1	—	—
Padlock	2	2	—	1	—	1
Paper	36	28	—	26	—	—
,, currency notes	4	2	—	2	—	—
,, dispensary ticket	2	2	—	2	—	—
Peg	2	1	—	1	—	—
Pencil	2	2	—	2	—	—
Pestle	12	11	—	11	—	—
Pickaxe	10	5	—	3	—	—
Picture	1	1	—	1	—	—
Pincers	2	1	—	1	—	—
Pipe, huqqa	4	4	—	4	—	—
Pistol	2	1	—	1	—	—
Plan of house ..	1	1	—	1	—	—
Plants, various ..	87	66	—	61	O. B. 1	1
Plates	4	4	—	4	—	—

Articles.	Total.	Blood stained.	Non-mammalian.	Source of blood.		
				Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Playing cards ..	6	6	—	6	—	—
Plough	1	1	—	1	—	—
Polo stick	2	2	—	2	—	—
Post card	1	1	—	1	—	—
Pot, earthen	61	45	—	41	S. G. 1	—
,, brass	18	20	—	17	S. G. 1	—
,, bell metal ..	10	1	—	1	—	—
Pouch	3	3	—	3	—	—
Powder	3	3	—	3	—	—
Railing	3	—	—	—	—	—
Rake	1	1	—	1	—	—
Razor	87	59	—	52	—	1
Reading-stand for Qoran	1	1	—	1	—	—
Reed	8	4	—	4	—	—
Rice	1	—	—	—	—	—
Rice-pounder ..	6	6	—	6	—	—
Rod	1	—	—	—	—	—
Roller	1	1	—	1	—	—
Sacking	147	125	—	114	O. B. 1 S. G. 1	—
Sail boat	1	—	—	—	—	—
Saliva	2	1	—	1	—	—
Sand	43	38	—	30	—	—
Saw	7	2	—	2	—	—
Scales	1	1	—	1	—	—
Scissors	5	3	—	3	—	—
Scrapings from accused body	1	1	—	1	—	—
Seeds	3	3	—	3	—	—
Serum	1	—	—	—	Goat 1	—
,, for W.R. ..	1	—	—	100 % positive.	—	—
Shells	3	1	—	1	—	—
Shepherd's crook ..	2	1	—	1	—	—
Shoes, sandals ..	150	86	—	72	—	—
Shrine of Lingam ..	1	—	—	—	—	—
Sickle	33	131	2	109	S. G. 2	—
Skin	5	3	—	2	Cat 1	—
Slate	1	1	—	1	—	—
Spade, kodali ..	147	90	—	80	S. G. 1	4
Spear	73	51	—	44	—	—
,, fish	5	2	1	1	—	—
Spectacles	1	1	—	1	—	—
Spoon	1	1	—	1	—	—
Staple	1	—	—	—	—	—
Sticks, bludgeons ..	336	237	2	195	S. G. 9 O. B. & H. 2	1
Stones	711	649	5	567	O. B. 9 S. G. 12	5
		Mammalian also.				

Articles.	Total.	Blood stained.	Source of blood.			
			Non-mammalian.	Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Stones, grinding ..	2	2	—	2	—	—
,, roller	1	1	—	1	—	—
Straw, grass	165	147	10	115	S. G. 6 O. B. 2 Pig 1	1
Sugar cane	7	4	—	4	—	—
Sweetmeat	1	—	—	—	—	—
Sword	301	242	—	217	S. G. 2	3
		Mammalian also 2.				
,, belt	1	1	—	1	—	—
,, scabbard ..	42	19	—	1	—	—
,, stick	5	1	—	1	—	—
Table	1	1	—	1	—	—
,, cover	1	—	—	1	—	—
Tape	4	3	—	3	—	—
Teeth	4	3	—	4	—	—
,, pick	1	1	—	1	—	—
Thread	24	19	—	19	—	—
,, sacred, of Hindus	5	4	—	4	—	—
,, waist	1	1	—	1	—	—
Tin	6	5	—	5	—	—
,, box	1	1	—	1	—	—
Tobacco	2	2	—	1	—	—
Toddy-tapper ..	52	21	—	18	S. G. 1	1
,, Hone for	2	2	—	1	—	—
Tongs	6	6	—	6	—	—
Tools	1	—	—	—	—	—
Torch-holder	2	2	—	2	—	—
Trunks, steel	3	3	—	2	—	—
,, wooden ..	2	1	—	1	—	—
Tub	2	2	—	1	—	—
Twigs, roots	53	46	—	41	S. G. 2 O. B. 1	—
Tyre	1	1	—	1	—	—
Umbrella, sunshade	18	8	—	8	—	—
,, cover ..	1	1	—	1	—	—
Vaginal discharge ..	13	4	—	4	—	—
				1 semen		
Washings of clothes	6	2	—	1	—	—
,, of hands and feet	11	3	—	2	—	—
Waterproof	1	1	—	1	—	—
Wax cloth	1	1	—	1	—	—
,, sealing	1	1	—	—	—	—
Weight	3	1	—	1	—	—
Wheel	5	2	—	1	—	—
Whip	4	3	—	2	—	—
Winnowing basket ..	2	2	—	1	—	—
Wire, fencing ..	3	—	—	—	—	—

Articles.	Total.	Blood stained.	Source of blood.			
			Non-mammalian.	Mammalian.		
				Identified.		Not identified as to exact source.
				Human.	Not human.	
Wire, fragments from exploded bomb	3	1	—	1	—	—
Wood, billets, planks	594	372	12	322	O. B. 5 S. G. 8 Goat 1	2
Wrench	1	1	—	1	—	—
Yoke of ox cart ..	3	3	—	3	—	—
Undetermined substance	24	16	2	7	S. G. 1	—
Grand total ..	28,693	20,147	149	17,492	S. G. 351 O. B. 138 Camel 1 Dog 4 S. G. & H. 9 O. B. & H. 6 G. & H. 1 Horse 4 Rat 1 Cat 4 Pig 2 Goat 3 Horse hair 1 Insect hair 2 Vegetable fibre 1	224
		Human also 3. Horse also 1. Mammalian also 5.				

Letters S. G. stand for Sheep or Goat.
,, O. B. ,, Ox or Buffalo.
,, G. & H. ,, Goat and Human.
,, S. G. & H. ,, Sheep or Goat and Human.
,, O. B. & H. ,, Ox or Buffalo and Human.
, Mam. ,, Mammalian.

Illustrative Cases.

1. From Murshidabad were sent some **earth and paddy** (unhusked rice) which were suspected to be blood-stained. The accused person, to whom the paddy belonged, stated that if it and the earth were stained with blood this must have come from a fowl which he had killed at a place where the paddy was stored, the earth being from the floor of that place. The spectroscope revealed the presence of blood in the earth and on the paddy-grains. In the earth only elliptical erythrocyte-nuclei were found; but on the paddy-grains both mammalian erythrocytes and elliptical erythrocyte-nuclei were present. One of the grains had both on it, and, curiously enough, both were present in one field of the microscope when a preparation of this grain was made. Further examination showed that the mammalian blood present was of human origin.

2. In a case of dacoity—gang robbery—from Singhbhum were sent portions of a **shirt and a loin-cloth,** which their owner had stated might well be blood-stained, as on the night before the dacoity occurred he had killed a sheep, and on the night after it he had killed a fowl. Blood was present on both garments; but no elliptical erythrocytes nor their nuclei were found, so that it was not fowl's blood that had caused the stains. The mammalian corpuscles which were present were found to be of human and not ruminant origin, and thus the explanation given by the accused person was proved to be a pure invention.

3. From Dacca in a murder case were sent four specimens of **earth and a bamboo** that were suspected to be stained with blood. On the bamboo and two of the specimens of earth—one of which had a human hair on it—no blood was found. In one of the remaining specimens of earth were found elliptical erythrocyte-nuclei. This earth was from a spot which the owner of the house, from which it was taken, said had been stained with pigeon's blood. The other specimen showed mammalian erythrocytes, but these were not proved on further examination to be of human origin. At least the story about the pigeon's blood was probably true.

4. In a murder case from Diamond Harbour there was sent the **loin-cloth** of a man who had been seen in the company of the murdered woman shortly before her death. He admitted that the cloth was blood-stained, and explained that this was due to his having killed a duck some time before. Examination showed that in the stains there were present only elliptical erythrocyte-nuclei, and thus his story was corroborated.

5. In Jhelum a man accused another of attempted murder, alleging that he had shot him with a revolver, at a spot where the ground was found to be stained with what appeared to be blood, and was, according to the complainant, the blood shed by him at the time. Oral evidence of the attack was also forthcoming. The police, who doubted the truth of the charge, sent the **earth** for examination. It was found to be stained with **non-mammalian blood** alone, and the case was dismissed as false.

6. From Dinajpur was sent a **cloth** which a Santhal woman alleged to be stained with her blood, shed when she was ravished. The stains were found to be due to **non-mammalian blood** alone—and no semen was found on the cloth. However, the Magistrate found that the case was true. But he also found that sufficient evidence was not forthcoming against the two men whom the woman had accused of having committed rape.

7. Some **sweetmeat,** which was supposed to have been mixed with **menstrual blood,** in order that it might act as a love-philtre, was sent for

examination by the man who believed that his affections were being played upon in this manner. There was **no blood present** in the sweetmeat, which consisted of ghi and sugar.

8. A man alleged that he had been cut down with a bill-hook by dacoits and that the blood shed by him had stained some **straw,** which was sent for examination. The straw was found to have only **non-mammalian blood-stains,** and the case was dismissed as false by the Court.

9. A girl said that she had been ravished by three men, and that each of them had had intercourse with her, with profuse ejaculation, while she was held down by the other two. Her **loin-cloth** was stained with blood, but not with semen. The blood was **non-mammalian,** so the charge of rape was not pressed.

10. Some **earth** that had been taken from near the spot where a corpse had been found was sent for examination. The defence was that if blood was present in the earth it must be that of a fowl. There was only **non-mammalian** blood present in the earth.

11. A man was caught **in flagrante delicto** with a calf. He explained that the charge was false, being concocted by the husband of his mistress, who had detected the intrigue but did not wish to bring discredit on himself. His **trousers** were found to be bloodstained, and he alleged that the blood was due to his mistress having been menstruous at the time of their last meeting. However, although according to his account the liaison had lasted for some time, he was unable to give the woman's name. On the trousers were found stains which were **due to human blood and to the blood of an ox or buffalo.** He was found guilty.

12. A man was accused of having stolen and killed a goat. When his house was reached a blood-stained **rag** was found lying in a corner. On being questioned about the stains on the rag he explained that they were due to its having been used as a "diaper" by his daughter, who was then menstruating. Mammalian erythrocytes were found, but further examination showed that these were not human, but of a sheep or a goat—most probably the latter. The man's story was thus proved to be absolutely false.

13. From Dinajpur in a murder case were sent two specimens of **earth** and seven pieces of **bamboo.** The owner of the house from whose yard and verandah the earth had come, and in whose room the bamboos were found, explained that if there were blood found on the articles it was probably that of an eel. Careful examination failed to detect mammalian erythrocytes, but large elliptical erythrocytes and their nuclei were present in great numbers in the stains on the pieces of bamboo. In the specimens of earth blood was present, but no erythrocytes could be found. Further examination showed that none of these articles had been contaminated with human blood. The truth of the explanation given was thus established.

14. From Purnea was sent a bunch of **jute-plants** which were suspected to be stained with blood of an ox, the case being one under section 429 I.P.C. Human blood was totally excluded by the results of the examination, which showed further that the blood on the plants was due to buffalo's or ox's blood.

15. The police of Purnea sent for examination **two sickles, some earth, and a bamboo,** which were suspected to have blood-stains on them. The origin of the blood was held to be doubtful. I was asked whether, if any were found present, it had come from a human being or a fowl. On one of the sickles no blood was present. On the other articles there was blood, which showed many elliptical erythrocytes with nuclei, but no circular erythrocytes. The stain-extracts did not react with anti-human

serum. Obviously the police had in this case good grounds for their doubts.

16. From Madras were sent scrapings of a blood-stain on the **plaster of the wall of a cow-house,** in which a man was alleged to have been murdered. I found that the stain was due to the blood of a ruminant and not to that of man. Further investigation, carried out at the suggestion of the Chemical Examiner, Madras, showed conclusively that human blood smeared on the plaster was easily identified as human blood —*i.e.* the plaster itself was not contaminated by reason of its site, so as to mask the reaction for human blood, and thus lead the observer into error.

17. The **loin-cloth** of a man who was accused of having committed murder was found to be stained with what looked like blood. He said that if it were really blood it must have come from bugs or other blood-sucking insects which he had found on the cloth and crushed. The stains were found to be due to human blood, but not to contain any vestiges of insect structure. When the case came to be tried he changed his story and stated that the loin-cloth was stained with the blood of his son, who had been kept standing in the sunlight until his nose bled, by the police who had tried to force him to bear false witness against his father. The Court found that both stories were false, but was compelled to quit the man for lack of sufficient proof of his guilt.

18. In a riot-case there was sent some **earth,** which was alleged to be stained with human blood. The place from which it was taken had been pointed out to the police as the scene of the riot, so that suspicion might be removed from the actual aggressors. The earth was stained with the blood of an **ox or buffalo** alone. The fact was that those interested had slaughtered the animal at that spot, with the intention of misleading the police.

19. A **quilt** and a **towel** were sent for examination in a murder case. The defence was that if these articles were blood-stained the blood had come from sores on the body of one of the persons accused. The quilt was found to be stained with **human blood.** The towel, which had been carefully washed, was found to be stained with mammalian blood, whose source could not be accurately determined. As no trace of pus-cells was found on either article the story told by the counsel for the defence was not corroborated by the findings in the laboratory. The chief actors in this murder were sentenced to death.

20. On a **loin-cloth** were found spermatozoa, which were obviously not human, but resembled those of a dog. At some distance from the seminal stain there was a blood-stain which was found to be due to the blood of a **dog.** Some time afterwards the owner of the loin-cloth produced another cloth on which were stains due to **human semen and human blood.** In our opinion he had produced, with some effort, an ejaculation while he was wearing the garment, in order to prove his innocence and our ignorance with regard to the first garment sent for examination.

21. A man was dragged out of his house and murdered in the street. One of his assailants was found to have bloodstains on his **clothes.** These stains were, he asserted, due to the blood of a bullock, which he had slaughtered; but we found that they were due to **human blood** alone. The Jirga, to which the case was referred, found him guilty.

22. A man, who was suspected to have committed a murder, stated that if any blood were found on his **clothes** it must have come from one of his camels. The clothes were stained with blood, which showed only circular erythrocytes, and was found to be of **human** origin alone.

23. The **clothes** of a man who was arrested on a charge of having committed a murder were stained with blood, which he stated was that of a cow recently slaughtered by him. This was only part of the truth, however: the stains were found to be due to the blood of an **ox or buffalo, and to human blood.**

24. The police suspected that if any blood were present on some **earth** which was sent for examination, it was that of a youth that had been murdered by a man who used to have homosexual relations with him, but had been provoked by finding him copulating with his sister. The family of the accused person admitted that he and the youth had been on these very intimate terms, but alleged that the blood, if any was found in the earth, was that of a cow. The earth was found to be stained with the blood of an **ox or buffalo** alone. The person accused was discharged.

25. A body was found, and as the death had been caused by violence, the police were only too ready to believe the story which was told by A, to the effect that B had confessed to him that he had done the deed with an **axe.** In B's house was found an axe whose blade was thickly smeared with blood. B admitted that he was the owner of the axe, but professed entire ignorance of how it came to be lying where it was found, and to be blood-stained. On the blade was found a hair which had come from the ear of a black goat, and the blood present was found to be of a **sheep or goat** alone. B was released from custody. A, who had tried to fix a false charge of murder on him, is still a free man.

26. A lad of twenty was accused of having ravished a girl of eight. No seminal stains were found on her **garments,** and the blood with which they were stained were found to be that of **sheep or goat** alone. The Judge admitted that this fact cast grave doubts on the other evidence, but convicted the lad and sentenced him to three years' rigorous imprisonment and a fine of ten rupees, or—in default—two months' rigorous imprisonment!

27. For examination was sent some **earth** which was dug up from the alleged site of a rape committed by a boy of 14 on a very young girl. An eye-witness testified to the rape, and the medical evidence showed that the girl had sustained injuries on her genitals; but the earth was found to be stained only with the blood of a **sheep or goat,** probably the latter. The boy received 15 stripes for indecent conduct.

28. The **body-cloth** of the alleged victim of a rape was found to be stained with **non-mammalian and mammalian blood,** which was certainly not of human origin. The Magistrate discharged the person accused, remarking that "the medical evidence makes it almost certain that the girl was raped, but the Chemical Examiner's report throws some doubt on it."

29. In a riot case was sent for examination some **earth,** which was alleged to be stained with the blood of a man who had been speared while defending his crops. The earth was found to be stained with the blood of a **dog** alone. The pleader for the alleged defenders of their crops had to admit that the evidence about the blood being human had been fabricated, and explained that his clients had been driven to concoct it by their fear that one of the chief witnesses in their favour would not support their case. The chief actors in this riot were sentenced to seven years' rigorous imprisonment, the counter-charge, brought by them as innocent defenders of their rights being dismissed as false.

30. In an assault case were sent two specimens of **earth.** The complainant had pointed out the place where he had been beaten, and the earth of this place was dug up. On the next day the alleged assailants pointed out a spot in another field, which they said was stained with

blood. As no blood had been seen there on the previous day, the investigating police officer suspected that the blood was that of a goat that had been slaughtered overnight, in order to lead him astray. The earth from the first field was found to be stained with **human blood** alone; that from the second field was stained with **human and hircine** blood. The persons accused of the assault were convicted.

31. It was suspected that a murder had been committed at a certain spot A, where the **ground** was stained with what appeared to be blood. The family of the person accused pointed out another spot B as the scene of the struggle. The earth from A was found to be stained with **human blood**; the earth taken from two places at B was found to be stained with **bird's blood** alone.

32. In a murder case a **loin-cloth** and a **coat** were sent for examination. The owner of the loin-cloth stated that it was stained with the juice of the fruit of **Phyllanthus emblica**. When he learned that the stains had been found to be due to human blood, he remembered that on a certain Monday his nose had bled. However, on the Sunday preceding that Monday it had been duly recorded that his loin-cloth was stained—the number of the stains being then noted. Of course his pleader made an attempt to escape by asking the Court to question the man as to whether his nose had ever bled before. When questioned he promptly answered that it used to bleed once a month. The owner of the coat explained that the stains on its front—three—were due to the blood of a water-fowl, which one of his friends had shot about a month before the date of the murder. Two of these stains were due to **human** blood alone; the third was due to the blood of a mammal, whose species could not be determined. On the back of the neck of the coat was found a stain due to the blood of an **ox or a buffalo**. One of this man's cows had been gored by another, and he had dressed its wounds. It is probable that, while bending down to do this, he had got the blood on his coat-collar. The owner of the loin-cloth and the owner of the coat were transported for life.

33. A man complained that he had been beaten, and pointed out the place where his blood had been shed. The police suspected that the **earth** was stained with dog's blood. It was found to be stained with blood, which had become too disintegrated for an opinion as to its source to be formed. The person accused stated that there had been an assault, but that the complainant had committed it, having attacked him in his own house. As a proof of this story he pointed out some stains on the floor of a room in his house. The earth forming this floor was found to be entirely free from blood.

34. One Gajru was asked to give an account of his movements during the period immediately prior to the finding of the corpse of an old woman. He told a long story, in which he made no mention of one Nandlu. Nandlu, on being questioned in Gajru's presence, told that he had seen Gajru following the woman on a certain morning—5 days previous to the visit of the investigating police officer. When Gajru heard this story, he promptly recollected that on the morning in question he had watched Nandlu and two other men, whom he named, following the woman. The spot from which he said he had seen them was held to be too far away for him to identify any one who was walking where he said those men were observed. Later he told how he had seen Nandlu and the others kill the woman. An **axe** and two **clothes** which belonged to Nandlu were sent for examination. The clothes were not blood-stained; the axe was stained with the blood of **sheep or goat** alone. Nandlu and the others were discharged.

35. Two castes in a Madras village had quarrelled. The Nadars

determined to start a riot, in which a Nadar should be killed, and then to report that he had been killed by the Naickers while he was engaged in worshipping the goddess. One Nadar proposed that his wife, whom he suspected of infidelity, should be the victim. Another proposed that his wife, who had left his protection, was a fit person to be sacrificed for the good of the caste. A third pointed out that his mistress was childless and had no relatives to avenge her death, so she was beaten to death, **after** a telegram had been sent from the nearest Telegraph Office to the district authorities about her having been murdered at the temple by the Naickers. In order to prove this story to be true, the Nadars slaughtered a sheep in front of the temple. When the police managed to get sufficient evidence to warrant the arrest of certain men, one of these was found to have blood-stains on his **loin-cloth**. These were found to be due to **human and ovine** blood. The persons accused were acquitted for lack of sufficient evidence to corroborate the story of the approver.

36. There was sent for examination a **knife** which was suspected to have been used in a murder. It was found to be stained with the blood of an **ox or buffalo** alone. The owner of the knife stated that he had recently cut up buffalo flesh with it. The persons accused of the murder were discharged.

37. In an assault case there was found a blood-stained **cloth**, hidden under the fodder in a manger which belonged to one of the persons accused. He explained that the cloth was stained with the blood of one of his sheep; but it was found to be stained with **human** blood alone, a fact on which the Court laid great stress. Two of the five persons accused were sentenced to rigorous imprisonment for one year.

38. A man complained that his father and brother had been beaten by certain men while asleep in his house. The police discovered that a fight had occurred in the roadway and not in the house, the house having been chosen as its scene in order to add to the assault a charge of housebreaking. The **soil** of the roadway was found to be stained with **human** blood.

39. Three men were accused of having committed culpable homicide. In the case an important point was the scene of the killing, which the prosecution suspected to have taken place at the victim's threshing floor, but the defence alleged to have occurred on the river-bank, where they showed a blood-stained place to the investigating police officer. The **earth** of this place was found to be stained with the blood of a **sheep or goat** alone. However, the stories told by the witnesses for the prosecution differed much from each other, so the three men were discharged.

40. In Sylhet a man swore that he had had his head cut open by a lathi blow, and lost a lot of blood which had soaked into the **cloth** that he was wearing at the time. The Medical evidence showed that the wound was caused by a sharp instrument and not a blunt one, such as a lathi. The cloth was stained with **non-mammalian** blood alone. The man was tried on the charge of fabricating false evidence and sentenced to two years' rigorous imprisonment.

41. A man stabbed his wife and her lover, who died a few days afterwards. He fled, but was caught, and explained that if the stains on his **clothes** were due to blood, it was that of a cow. The garments were found to be stained with **human blood** alone. He was sentenced to five years' rigorous imprisonment.

42. Three men were accused of having murdered a man. A. owned a **field**, in which a spot was stained with what turned out to be **human blood**. The earth of a field belonging to B. was also stained with **human blood**. The **Khalka, patka,** and **pyjamas** of C. were found to be stained. He explained that the stains on the khalka were due to snuff—they were

found to be due to **human blood.** The stains on the patka and pyjamas he said were due to rust. The patka was stained with **human blood**; the pyjamas had been well washed, but we were able to report that they were stained with the **blood of a mammal,** whose species could not be determined.

43. A man reported that his master had been killed while sleeping at the threshing floor. He was found to have stains, which seemed to be due to blood, on his clothing, and cuts on the palmar surface of the fingers of his right hand. He pointed out to the investigating police officer where the **grass-chopper,** with which the deed was done, was lying in the house of the deceased. He confessed his guilt to a Deputy Magistrate, who noted that he had taken care to ascertain that the confession was made voluntarily, and explained that it would not lead to the man's discharge; also that he had ordered the prisoner's handcuffs to be removed, and had kept him for half an hour in Court—whence all policemen had been excluded—before recording the confession. On the fourth day after the murder was committed the cuts on the man's fingers were found to be three or four days old by the Assistant Surgeon, who examined them. The handle of the chopper was tightly wedged into the ring of the hand by means of a rag, on which the Chemical Examiner found blood-stains. When tried before another Magistrate he said that any blood that was found on the chopper was that of a pigeon which his master had killed with it; and that he had confessed because the police had told him that he would get off scot-free if he did so. At the Sessions trial he stated that there must have been a snake or a scorpion concealed in the grass that he had been chopping, and that its blood had stained the chopper. We found that the rag was stained with **human** blood alone.

He also stated that he had never made a confession, but that the Deputy Magistrate had taken down a statement that was dictated by the two constables who took him to Court. As to the murder, his story was that it had been done while he was asleep, but he had seen three men bearing lathis run away from the spot, being awakened by the noise made by his master. As the night was dark he could not identify the men (it was the second night of full moon). The assessors found him not guilty, but the Judge sentenced him to death.

44. In a murder case it was suspected that a **billhook** had been used to inflict the injuries. The owner of the billhook and his mother stated that they used it to cut beef some four days before the date of the murder, and to cut up a fowl on the day following the murder. On the blade were found stains of the blood of an **ox or buffalo** alone.

45. A man was accused of having committed house-trespass by night. On the **floor** of one of the rooms, and on the floor of the verandah, the investigating police officer found what looked like blood-stains. The owner of the house stated that these had been caused by the blood shed by the accused person, whom his wife had struck with a billhook. The accused person denied this, and said that he believed that the blood was that of a cat, produced **ad hoc** by the owner of the house, who desired to get him into trouble. The earth from the room and verandah floors was found to be stained with **cat's blood** alone.

46. From Jhelum were sent a **kurta** and a **chadar** for examination as to the stains on them. They belonged to one Karim, who was accused by one Bakhash of having killed the son of the latter. The boy's body had been found with the throat cut in a mosque, and at the autopsy it was discovered that death was in all probability due to his having been strangled before the injury to the throat was inflicted. Karim stated that the stains on his clothes were due to the blood of a sheep which he

had slaughtered. It was found that the stains were due to the blood of a **sheep** or **goat** alone. Karim was discharged.

47. A youth of 19 was caught **in flagrante delicto** with a young **heifer.** On his **loin cloth** were bloodstains. These were found to be due to **human** blood and the blood of an **ox or buffalo,** and the **earth** of the site of the intercourse was found to be similarly stained. The youth confessed before a Magistrate, but after spending a few days in the under-trial prisoners' ward he, as is usual, retracted his confession, which he said had been extracted from him by threats. He was sentenced to 4½ months' rigorous imprisonment in consideration of his youth, and the fact that in Ahmednagar bestiality is a very common occurrence, the animal generally used being a she-ass. The Magistrate was inclined to believe that the offence in this case was brought to notice because the animal was a heifer and a young one.

48. At Hinwaza in Prome District a **bullock** disappeared from the grazing grounds. Two men said that they had seen a man leading it away but could not identify him. Four days afterwards various houses in a neighbouring village were searched, and in one there was found some dried flesh that **looked like beef, but was said to be the flesh of a pony** that had recently died. Two tins full of this much-decomposed flesh were sent for examination, and it was found to be **horse-flesh** alone. The charge of theft of a bullock was dropped.

49. From Nawabshah in Sind a bloodstained **cloth** was sent for examination to the Chemical Analyser, Karachi. It was alleged that a lad had been wearing it when he was knocked down by two men, of whom one then committed **sodomy** with him. Numerous witnesses came forward and testified to his having suffered much laceration of the anus, and it was alleged that he had bled long and freely, also that there were seminal stains on the cloth. Two witnesses deposed as to their having been attracted to the spot by the lad's cries, and as to their having caught one of the accused **in flagrante delicto.** But there was **no semen** on the cloth, and on its being forwarded to us we discovered that the blood on it was that of a **sheep or goat** alone. The accused persons were discharged, and those who had testified against them were called on to show cause why they should not be prosecuted for perjury.

50. From Mianwali was sent a **waistcloth** which was said to be stained with the blood that had come from a **woman's nose** when it was cut by the accused person. He alleged that the blood was that of a **cock** that he had killed. The cloth was found to be stained with **both non-mammalian and human blood.**

51. An oil seller named Dila reported to the police that on the previous day he had found in his field two boys, who had cut a lot of paddy and were going to remove it when he came upon them. He took the paddy away from them, so they called three men to help them. These set upon him and Gobind, who had come to his aid, and a free fight took place. When the case came to trial the alleged paddy-thieves and their friends explained that the case was a false one, and was due to their having had a quarrel with Dila regarding the boundary between their fields and his. In his report Dila has stated that the paddy had been cut at the north-east corner of his land, where he pointed out the stubble to the investigating police officer; but in Court he said that the stubble was on the south-west corner, which abutted on the lands of his assailants He had a small cut on his forehead, and from this he said a large quantity of blood had flowed, and stained the **earth** at the scene of the assault. This earth was sent for examination, and was found to be stained with the blood of an **ox or buffalo** alone. He had no blood on his clothes in spite of the alleged copious hæmorrhage. The Magistrate

in his finding remarked that he had no doubt about Dila's story being a concocted one, but as there was "unfortunately not sufficient evidence" to bring this home to him, and "no reasonable chance of his conviction," he refrained from sanctioning his prosecution for fabricating false evidence.

52. A bania-pedlar, who used to sell groceries in the villages, had a pack-bullock to carry his wares. This bullock one night returned home alone, and was found to have lost the bell that used to hang from its neck. Next day the corpse of its master was found in the fields of an adjoining village. As there were marks of violence on the body, the police arrested "the only suspicious character" of the village, who denied all knowledge of the matter. He explained that the bloodstains on his **clothes** were those of a **black buck** that he had recently killed, he being a shikari. The clothes were sent for examination, and it was found that they were stained with the blood of an **animal akin to a goat** alone. He was discharged, as it was held that the finding of the bell by him was not a fact, but that he had been induced to "find" it by the investigating police officer.

53. A man who, as the Magistrate noted, was between 60 and 70 years of age, with his body covered with wrinkles, was alleged to have taken two girls aged 14 and 11 behind a bush and there **ravished** the younger of them, who was his niece, all the while keeping the elder by his side. At first this little girl complained of a simple assault, but later began a story of rape. It was alleged that two witnesses stoned the ravisher, who retaliated after he had committed the rape. Other villagers came to the scene, and when they departed left the girls to take care of themselves. When the little girl reached the village she informed the grandmother of her companion, and next morning she was said to have pain in the genitals and to have found blood on her sari. Another story was that she had seen the blood on the sari immediately after the rape, but had not mentioned it to the eye-witnesses of the act. Medical examination revealed rupture of the hymen with some inflammation of the vulva. **No semen** was found on the clothes worn by the ravisher and girl, but on the latter were found stains of the **blood of a sheep or goat** alone. The old man was discharged by the Magistrate, who held that the accusation of rape was false and had been brought because there had been several quarrels between him and the parents of the girl.

54. The cloth worn by a little girl was sent for examination, as it was supposed to be stained with the blood that had flowed from her vulva, as the result of her having been **ravished**. Her story was that the accused man was drunk, and had seized her and dragged her into a walled enclosure, where he had ravished her by holding her down so that her legs were on his shoulders while he effected penetration. She produced two witnesses who, she said, had been urinating in the enclosure at the time, and one of whom had beaten her ravisher with a shoe to make him desist. Of these witnesses, however, one said that all that he knew was that he saw the girl leave the enclosure followed by the accused person, who was drunk; that the girl, who was weeping, said that the man had caught hold of her, and that for thus frightening her he gave the man a beating. The other witness denied all knowledge of the affair. The stains on the **cloth** were found to be due to the blood of an **ox or buffalo** alone. The alleged ravisher was discharged, as the Magistrate held that the case had been got up by the girl's parents, who had stained her cloth merely to exaggerate matters, because she had been terrified by the drunken man.

55. On 8th October a Kumhar girl, aged about 14, accompanied by her little brother, was grazing the family's donkeys outside the village. A young bachelor was said to have seized her by the hand, and in the

words of the judge, "dragged her into an isolated solitude which was covered with bushes and hedges." Here he is alleged to have thrown her down and satisfied his lust in the most brutal manner. She is stated to have bled freely, and, after the young man had left her, to have gone home crying bitterly, to find that her little brother, who had run away when she was being so brutally treated, had already told his grandmother what had occurred. The grandmother is then said to have told the girl's father, who went to report the matter to the village watchman. On the way, they met the grandmother carrying the girl (aged about 14) in her arms. It was alleged that at that time the girl's lehnga and her legs were "wet with blood." The grandmother washed the girl's vulva and fomented it. The matter was duly reported at a thana 12 miles away, and a constable was sent to arrest the young man, who is alleged to have gone to seek shelter from some zamindars and obtain pardon. The Civil Surgeon reported that "the hymen had been torn some months before, and that there were marks of scratches on the back of the girl, which he thought had probably been caused by nails." The girl's **"lehnga"** was examined by us, and on it were found stains of **semen** and **non-mammalian blood, no trace of human blood** being present. The judge commented on this finding as follows:—

"The presence of semen on the skirt of the ravished girl is an evidence of the very clearest type that some one had sexual intercourse with her in an agitated and confused manner. As for the blood, which has been reported to be non-mammalian, the conclusion drawn by the expert is inconsistent with the very strong evidence for the prosecution. The fact that semen was found on the girl's *lehnga* by the Serologist, side by side with the blood, materially supports the case for the prosecution. The girl gave her evidence in a very simple, honest and unpretending manner, and I was very much impressed by her innocent demeanour.

"The accused pleads that he had driven away the girl's donkeys from his Juar field that very day. This annoyed the kumhars, who falsely charged him with the said crime. The accused gave no evidence to support his allegation, which is obviously too trivial. The girl is still unmarried, and it does not stand to reason that the parents could have degraded themselves so much as to proclaim their daughter's dishonour in such a bad manner. The imputation of rape is the worse kind of allegation against an unmarried girl's character, and it is inconceivable that a father would under any circumstances care to disgrace his daughter so openly in order to avenge himself for such a petty matter as the one asserted but not proved by the accused. In my opinion, the offence of rape is quite proved against the accused. Both the assessors have found the accused not guilty, but have given no reasons for disbelieving the cogent and convincing allegations of the ravished girl Bhagirthi and her brother Haria. Their verdict is altogether perverse and contrary to the positive and reliable evidence for the prosecution. In my opinion, the case is a perfectly true one. Disagreeing with both the assessors, I convict the accused of the offence of rape, and in view of his young age sentence him to eighteen months' R.I."

But the case is by no means so simple as the learned judge thought it was. The question of the presence of non-mammalian blood instead of mammalian on the girl's lehnga is not one of opinion merely, but of hard fact. Apart from this, the absence of any trace of human blood on the garment is, as the judge said, "inconsistent with the very strong evidence for the prosecution"; just as inconsistent, indeed, as is the evidence of the Civil Surgeon who found that the girl's hymen had been torn **"some months before,"** although, according to the evidence for the prosecution, the deed occurred three days before he examined her.

Incidentally, we may remark that it does not seem to be probable—to put the matter at its best—that a girl "aged about 14," who had walked a considerable distance immediately after the rape, would be carried in her old grandmother's arms, even for a few paces; and there is no mention of her having become unconscious as the result of all the bleeding, which is said to have caused her lehnga and legs to be wet.

It seems to us that the story can be explained thus :—

Some months before, this girl had sexual relations, with the result that her hymen was torn. Whether this was caused by coitus or by manipulations matters not; the point is that she was not so innocent as she might have been, and was not likely to receive injuries from coitus on the day in question, such as would cause profuse bleeding. The scratches on her back were probably caused by her having lain on the ground amongst the bushes during the act to which she had been a consenting party. When all was over she discovered that her little brother had run away, and guessed that he would tell what had happened, so she was ready enough to bear witness that she had been forced to do what she had done. The grandmother naturally tried to save her grandchild's reputation, being ignorant of the happenings of some months before. Whence the non-mammalian blood came is a question. Probably it was that of a fowl, or possibly that of a dove. The quarrel about the Juar field, from which the donkeys were driven by the young man, is obviously but a trivial one; but in India small causes such as this often produce great effects such as a charge of rape. The presence of semen on the lehnga does not lead us to suppose that this act was done "in an agitated and confused manner," as the learned judge wrote. The semen had come from the girl's vagina after she had finished coitus: this is all that can be said of it. Had there been no little brother there that day it is likely that the young man would be still at liberty.

56. When the house of one of those accused of having committed a murder was searched, the following articles which appeared to be blood-stained were seized by the police: A, the bamboo **handle of a dibble**; B, a **quilt**; C, a piece of **bamboo matting**. The man's wife explained that the stains on A were due to **betel-stained saliva**; on B, to bloody **disharge from her vulva**; and on C, to the **blood of a cow**. As a matter of fact, the stains on A were due to **betel** probably; while those on B and C were **certainly not due to blood**. This illustrates the difficulties with which the police have to contend when investigating a case.

57. A man was killed in a frontier village. One Majid was suspected of having taken part in the **murder**. In his house was found a **knife** which appeared to be stained with blood. This, Majid said, was that of a sparrow or some animal, but not human blood. The knife was found to be stained with **non-mammalian and human** blood.

58. In the early hours of the morning, a man who was watching his ground nut field fired at a wild pig which was damaging the crop. After wounding the pig which fell, but recovered and bolted into the jungle, the bullet hit a boy who was on watch on a platform about 100 yards away, and inflicted injuries of which he died. A, the sand and straw on which the wounded pig had rolled, and B, some sticks from the platform on which the boy was sitting, were sent for examination. On A was found **pig's blood** alone; on B, **human blood** alone.

59. In a riot about land a man was killed. His faction, A, declared that the riot had occurred in a certain field, and that he had been killed there. The other faction, B, denied this, and pointed out blood marks in another field as caused by his having been killed there. Some of the bloodstained **straw** found there was sent for examination. Faction A declared that the blood on the straw was that of a **goat**, which had been

slaughtered to mislead the authorities into believing that the riot had occurred on the land of faction B, and that faction A had been the aggressors instead of the attacked, The stains were due to **human blood alone.**

60. The guardian of a **mosque** one morning found in a corner of the courtyard some blood. This he reported to the leaders of the Moslem community, who informed the police. The blood was sent for examination, and found to be that of a **goat** alone. Obviously it had been put there with the intention of leading the Moslems to believe that the mosque had been defiled by pig's blood. As in most parts of the Empire pigs are kept outside the villages and looked upon, by Moslem and Hindu alike, as scavengers and unclean, it is probable that many of the cases of suspected defilement of mosques which have occurred in the past were not really such. No Hindu would care to touch the body or blood of a pig, however desirous he might be to irritate his fellow subjects, while the killing of a goat is to most Hindus but a small matter, and so long as the fact that it was a goat that furnished the blood is not known to the Moslems, the desired effect can be obtained; for it is not every Moslem who would be content to wait for definite proof as to the source of the blood, before making the matter known to others.

61. A man complained that his **horse** had been wounded when it was at A, in a certain field, and had died of its injuries. The person arrested for the offence showed, on the fourth day, another place, B, as the site of the deed. The earth from A and B was sent for examination, and we found A to be free from blood, while B was stained with the **blood of a horse** alone.

62. X was accused of having committed sodomy with Y, a schoolboy aged 12. Y alleged that penetration had been effected without his knowledge as he lay asleep, but that he was awake before the act was consummated. The defence was that the case was false, aud due to X having dunned Y for one rupee eight annas, the price of a cloth. Y's dhoti was sent for examination as to seminal stains. There were none on it; but we detected a minute speck of blood which was that of a sheep or goat. Of course the barrister for the defence made much of this finding, but as the speck was a very minute one the magistrate held that it did not invalidate the story for the prosecution since, as he put it, no Sub-Inspector of Police gifted with the smallest understanding would have asked for the dhoti to be sent for examination had he known that it had on it a speck of sheep or goat's blood, and the evidence of Y's two room-mates was very clear as to X's guilt.

63. A accused B, C and D of having ravished her. She said that B threatened her with a sword, and ordered her to follow him into the jungle. When she refused, C, who was carrying a stick, aided B to carry her off. Then C ravished her, and B and D, who had joined them, did the same. While D was so engaged she managed to get hold of the stick, which C had left on the ground beside her, and lunged with it at D's face, which bled freely, some of the blood dropping on to her bodice. While D was busy washing the blood from off his face she escaped to the house of E, one of her relatives, where see got a cloth to cover her nakedness. A's aunt, F, told a different story. She said that B, C and D had come to her place, and that C had given B a push, which caused himto fall on F, A and G. B felt ashamed, and ran away. First she had said that B had dragged A away, being aided by C. This she explained was due to her having been angry, and she asseverated that it was C who had dragged A away, being aided by D.

The bodice of A was found to have on it stains of blood, but as the blood was non-mammalian alone, her story was not strengthened by the

fact. It came out in evidence that A was the daughter of a man who had been kept in custody for a day by B's father, who was a magistrate; and that E, who corroborated A's statement of her escape in a state of nudity, was at enmity with B's father on account of a quarrel about money matters. The three youths accused in the case were discharged.

As an instance of how the police, who receive *very* little aid from the general public in this country, are forced to utilize every scrap of what might turn out to be a *pièce à conviction* in a murder case, I may mention that from Diamond Harbour I received (1) some palm-leaves; (2) a bamboo cane; (3) some bamboo matting; (4) two bamboo poles; (5) a cloth; (6) a piece of rope, and (7) a dhoti. All of these were suspected to be blood-stained. On none was there any blood detected, but on the cane were found stains very much like those of blood at first sight, but really due to betel-stained saliva.

CHAPTER VII.

ASPHYXIAL DEATHS.

THE violent deaths of common occurrence which result from asphyxia more or less directly are: (1) Hanging, (2) Strangulation and Throttling, (3) Suffocation, and (4) Drowning.

The *post mortem* signs of asphyxia which are found in these forms of violent deaths are largely the result of the violent respiratory efforts, at first mainly inspiratory, and latterly attended by convulsions. They are:—

External: (1) Lividity of lips, finger-nails, and skin generally, to be distinguished from hypostasis by not being confined to the most dependent parts. (2) Prominence of eyes, especially in strangulation. (3) *Rigor mortis*, slow in onset.

Internal: (1) Blood unusually fluid from excess of carbonic oxide. (2) Lungs and meninges of the brain may be either congested or anæmic. (3) Petechiæ beneath serous membranes. —These minute extravasations of blood, from the size of a pin's head to a small bean, beneath the pleural covering of the lung ('*Tardieu's* spots') or under the pericardium, are very characteristic of asphyxia, if the deceased was not previously suffering from blood diseases, such as scurvy and purpura, in which petechiæ are apt to occur. They may, however, be absent in undoubted asphyxia, and are most likely to be present when the asphyxia occurs rapidly. They should be looked for especially at the root, base, and lower margin of the lungs, on the pericardium, under the scalp, and in infants on the thymus gland. They are readily distinguished from hypostasis by their punctate or petechial character.

Hanging.

In this form of asphyxial death the body is suspended by the neck and the constricting force is the weight of the body or head. It is unnecessary that the body should be suspended off the ground or other support, or even that it should be in the upright posture.

Suicidal hanging is a relatively rare form of suicide in all countries. In India, statistics show that between one-third

and one-half of the suicides of both the sexes in the town of Calcutta and in the Panjab, and of the male suicides in the presidency of Madras, hang themselves, whilst in Bombay suicidal hanging is rare. Hanging also is the mode selected by about 18 per cent. of the female suicides in the two last-mentioned presidencies. All the 130 cases of hanging seen by Dr. Mackenzie [1] during nine years in Calcutta were suicidal. Sixty-five were male and sixty-five were female, and all were adults. The alleged causes in these cases were :—

Family disagreement ..	38	Remorse at having led immoral lives	2
Ill-health	35	Grief on account of the death of a near relation ..	1
No reason assigned	24	Serious illness of a child ..	1
Drunkenness	9	Disappointment in love ..	1
Insanity	9	Jealousy	1
Poverty	4	Theft	1
False accusations	2		
Found in possession of counterfeit coins	2		

The nature of the rope by means of which these 130 persons committed suicide : seventy-three used ropes of various materials and thickness. Thirty suspended themselves by means of their *dhoties*, *saries*, or *chadars*. Twenty-five cases were not noted. One person, a determined suicide, used both a rope and the cloth he wore to destroy himself, and a Brahman hung himself by his Brahmanical thread !

Case.—**Suicide by Brahmanical thread.**—This man was a big, stout Brahman ; he returned home late at night boisterously drunk, and commenced to abuse his own family and his neighbours. The family, expecting that he would assault them, locked him out of the house into the outer courtyard, where he entered a cowshed and hanged himself. He twisted his Brahmanical thread into several ply, and was found suspended off the ground by means of it. The mark of the cord round the neck corresponded with the Brahmanical thread. It was very narrow and deeply indented into the skin of the neck, which was parchment-like in appearance.

Homicidal cases are rare in India, except in lynching. Chevers mentions three, one where a woman, with the aid of three men, hung her husband in revenge for having beaten her some days previously ; another where a husband hung his wife as a punishment for adultery ; and a third where the inhabitants of a village, discovering a man from a neighbouring village in the act of committing a theft, hung him on a tree in the middle of their village. More frequently in India, in homicidal cases where the body is found hanging, the cause of death is strangulation or mechanical violence, and the body has been hung to avert suspicion (see *Cases* next page). Accidental cases also are rare, but are sometimes met with. Judicial hanging : this is the judicial mode of execution in India.

[1] *Ind. Med. Gaz.*, 1888, p. 299.

Case.—**Murder by strangulation; subsequent suspension** of the body.—A man of Mymensing, having intrigued with a widow, and not giving her sufficient means for her support, she complained to the village *panchayet*, who decided that both parties should be beaten. The man was seized by his father, and was struck several blows, but the woman managed to escape. The paramour, enraged at having been summoned and beaten before the *panchayet*, pursued her with three of his relatives. On coming up with her, they strangled her, and, hanging her body on a tree hard by, reported that she had committed suicide.—Chevers, *Med. Jur.*, p. 529.

Case.—The father and brothers of a girl, of Tipperah, finding her in company with a man with whom she was intriguing, seized the man, and holding him down by the neck, arms, and legs, strangled him. They then hung up the corpse, and reported that he had destroyed himself.—Chevers, *ibid.*, p. 592.

Case.—A Bogra woman was found hanging. *Post mortem* examination showed clearly that strangulation by hand, and not by hanging, was the cause of death.—Chevers, *ibid.*, p. 593.

Case.—**Murder by mechanical violence; subsequent suspension** of the body.—A man of Sylhet struck his wife with a piece of split bamboo about the body until she died, for eating more than her share of *pan* (betel). He then hanged her body on a tree.—Chevers, *Med. Jur.*, p. 597.

Case.—The wife of a man living in the 24-Parganas having a criminal intrigue with another Hindu, she and her paramour enticed the unfortunate man out of his house at night, killed him, or rendered him insensible (it would seem by severe blows), and suspended his body to a tree.—Chevers, *ibid.*, p. 598.

Case.—It appeared, in a trial at Cuttak, that a Hindu, charging another with theft, beat him to death. The man's body was afterwards found suspended, with marks of violence upon it, in such a position as to render it evident that he had not hanged himself.—Chevers, *ibid.*, p. 598.

Case.—A man, probably trampled to death, body found hanging. A Hindu, aged about sixty. *Post mortem* appearances—"Face livid and slightly swollen, especially on right side, on which the body had been laid. The tongue was not swollen or bitten by the teeth. A bruise about $1\frac{1}{2}$ inch in diameter on right side of the forehead. A livid depressed mark, about $\frac{1}{2}$ inch in diameter, round the neck and behind right ear. In front of the neck the mark was between os hyoides and thyroid cartilage. There was another depressed mark under the forehead. *Head.*—Considerable amount of coagulated blood in tissues of pericranium, corresponding to bruise on forehead. Brain healthy, slightly congested on surface. A considerable quantity of fluid in ventricles, and at base of brain. *Chest.*—A large quantity of extravasated coagulated blood among muscles and tissues covering the ribs. The ribs, from the third to the last, were fractured in two places on both sides; lungs healthy, uncongested; heart empty. *Abdomen.*—Extensive rupture of liver on its posterior aspect; all other organs healthy."—Harvey's *Beng. Med. Leg. Rep.*, p. 83.

Case.—Punctured wound mistaken for a gunshot wound, body suspended after death.—In this case, a Mussulmani, aged thirty-eight, was at first reported to have died from hanging. There was a rope close under the chin, passing upwards behind the ears, and the head was bent on the chest. On lifting the head, a wound, described by the medical officer who made the examination as a gunshot wound, was found between the attachments of the sterno-mastoid muscle, a little above the clavicle. The wound contained a large clot of blood, and its edges were turned downwards and inwards. Apparently it was not seen until the head

was lifted. The right lung was torn through from apex to base, and a circular hole, of the same size as the one in the neck, passed right through the liver. The right kidney was bruised, but not wounded. A large quantity of blood was found in the cavity of the thorax, and a large quantity also in the abdomen. Deeming the wound a gunshot wound, the medical officer, not being able to find the bullet, gave as his opinion that it had probably passed behind the kidney into the thigh. The woman's husband afterwards confessed to having killed his wife, by thrusting a pointed perfectly circular solid bamboo into her body. The body was afterwards hung up to avert suspicion.—*Ibid.*, p. 214.

Case.—**Suicidal hanging, Partial suspension.**—In 1907 a Brahman lunatic in the cells of the Bombay Police Hospital hanged himself from the bars of the door, 33 inches from the ground, with his sacred thread, by lying in an inclined position.—Prof. Powell, Bombay.

Case.—**Accidental hanging.**—" During the breakfast hour at a cotton mill near Aberdeen, one of the men was toying with a female fellow-worker to whom he was attached, and in sport threw around her neck a loose leather strap suspended from the roof of the apartment. At this moment the machinery was set a-going, and the girl was drawn up to the roof by the strap, and suspended there for a few minutes before the engine could be stopped, too late for saving her life."—Ogston, *Med. Jur.*, p. 528.

Case.—**Death from hanging.—Arsenic found** in viscera, probably self-administered.—In a case from Shahapur (Thana district), the body of a Mahar was found hanging to a tree outside a village. On examination, there was found an abrasion of the skin round the neck just below the chin, commencing from the thyroid cartilage, and extending backwards and upwards on both sides, with discoloration of the parts around. Both lungs were found gorged with blood, and the brain was congested. The mucous membrane of the stomach was red, and had yellow patches on it. On analysis, arsenic was found in the viscera, about four grains being present in the contents of the stomach.

Mode of death in hanging depends on the way the cord is applied, and on other circumstances. It may be by:—

1. **Fracture** or dislocation of cervical vertebræ, followed by almost instant death from pressure on the spinal cord. This occurs when the body falls some distance before the strain comes on the rope, and is the mode of death sought to be attained in judicial hanging.

2. **Asphyxia,** from constriction of the air passages, with rapid death. Death from pure asphyxia does not often occur in hanging, though Dr. Mackenzie states it was the most common mode in his 130 cases.[1] It may, however, occur if the rope is tied low down the neck, and a knot or some hard object contained in the ligature presses directly on the trachea.

3. **Apoplexy,** from pressure of the ligature on the large veins of the neck, if the tape is tied too high up the neck.

4. **Mixed asphyxia and apoplexy.**—This, except in judicial hanging, is the most common mode of death, occurring in about 77 per cent. of

[1] *Loc. cit. Ind. Med. Gaz.*, p. 299.

those cases of death from hanging in which the cause of death is other than fracture of the neck.

In Dr. Mackenzie's 130 cases no less than 119 or 91·54 per cent. died from asphyxia ; 8 or 6·15 per cent. from asphyxia, as well as apoplexy ; 2 or 1·53 per cent. from syncope, and 1 or 0·76 per cent. from apoplexy.

Rapidity with which death occurs varies.—It occurs almost instantaneously if the neck is fractured, rapidly if death takes place by apnœa; and least rapidly if apoplexy is the mode of death. If there is no injury to the spinal cord. and the stoppage of air is not complete, five to eight minutes is the common fatal period; but it is possible that life may be restored after even half an hour's suspension.[1]

Treatment.—If the body of the person hanged is cut down before life is extinct, attempts at resuscitation should be made by opening a large vein to relieve the right side of the heart and cerebral congestion, followed by warmth and friction and diffusible stimulants, especially ammonia and sternutatories, and endeavours to restore the respiration and circulation by manipulation as in drowning, which see. The attempts at artificial respiration must be persisted in for a long time until natural breathing is established or the case proved to be hopeless.

Post mortem signs.—These are generally those of asphyxia with the special signs in addition.

1. **Signs of the 'mode' of death,** *e.g.* fracture or dislocation of the cervical vertebræ ; or the *post mortem* appearance of asphyxia or apoplexy, one or both.

In all the 130 suicidal cases examined by Dr. Mackenzie no fracture or dislocation of the neck was found ; but the following case is reported by Dr. H. G. Johnston of Jamaica, W. I.

Case.—**Fracture.—Dislocation in suicidal hanging.**—A negro aged 24 (D. McL.), a sufferer from extensive chronic ulcer of the leg, climbed a tree and tied a thin ($\frac{1}{2}$ inch diameter) bark rope to a horizontal branch, and put the other end of the rope by a slip-noose around his neck, and threw himself down about a five-foot drop. When found, his feet were only a few inches from the ground, the knot being behind the left ear. There was a fracture-dislocation of the axis.

2. **Mark of cord.**—This in death from hanging is usually, but not always, oblique and non-continuous, *i.e.* does not completely encircle the neck. It is usually (in about 81 per cent. of cases) situated between the chin and the larynx, and is very seldom (in about 2 per cent. of cases) below the larynx. In appearance it is usually a well-defined furrow, which, according to the length of the period of suspension, may (*a*) show no change of colour, or at most a red blush ; or (*b*) be condensed and white

[1] Tidy's *Legal Medicine*, II. p. 191.

at the bottom, the edges presenting either no change of colour or being red, and the skin beyond violet; or (*c*) if the period of suspension has been long, be dry, hard, yellowish-brown, and horny, resembling parchment.

In Dr. Mackenzie's cases in which a rope was used, the mark on the neck was well-defined, indented, and parchment-like, while in the cases where cloth ligatures were used, the marks were faint, of a reddish colour, and not parchment-like, except in places where the cloth was twisted, and where the pressure was great.

Abrasions are sometimes found in the course of the mark, but ecchymosis is rare; and sometimes *there may be no mark*. After noting the exact situation and external appearance of the mark on the neck, two incisions should be made round the neck, one about an inch above, and the other about an inch below, the mark. These should be connected at the back of the neck by a vertical cut, and the skin carefully dissected up from behind forward. The subcutaneous cellular tissue will then usually be found to show a condensed white or yellow line. The underlying soft parts and the spine should then be examined. Such dissection should be made also in all cases where strangulation is suspected.

In not one of Dr. Mackenzie's 130 cases were the muscles of the neck, the larynx, trachea, or large bronchi injured, and in none of them was there any extravasation beneath the skin of the neck, or blisters above the constriction of the cord.

Much local injury may be found in cases where, as in judicial hanging, the body falls some distance before the strain comes on the cord. Such cases excepted, much local injury points to strangulation rather than to hanging; or if hanging be the cause of death, to homicidal, rather than to suicidal hanging.

3. **Other appearances.**—The face may be found pale, the features placid, and the eyes not unduly prominent. This Harvey found to be the most usual condition in fresh bodies; or, especially if decomposition has set in, the face may be found swollen and the eyes protruding. In only 37·5 per cent. of Dr. Mackenzie's cases were the eyelids open, and eyeballs protruding. Pupils are nearly always dilated. Tongue is pressed against the teeth, or partly protruding between them and bitten. Genital organs frequently show signs indicative of excitement, accompanied by discharge of mucus, or sometimes of blood, and in males by emission of seminal fluid. Expulsion of urine and fæces sometimes takes place. Lungs.—Congestion of the lungs is by no means invariably present. Out of 834 cases of death from hanging, included in the returns reported on by Harvey, in 738 the lungs were congested, in 77 natural, and in 19 collapsed. Rupture of the superficial air cells, spots of sub-pleural ecchymosis, and apoplectic effusions into the substance of the lungs, are all infrequent in hanging, but may be present.

Saliva running in straight lines down the chin and chest are usually found, and if present, are important as indicating suspension during life.

In Dr. Mackenzie's 130 cases, in 81 the position of the tongue was noted, and in 41 or 50·61 per cent. it was found to be protruded between the teeth, but not injured; in 61 cases a note was made as to whether it was bitten, and of these the tongue was found injured in 16 or 26·22 per cent. A note was made in 40 cases regarding the eyes, and in 15 or 37·15 per cent. the eyes were open, and the eyeballs were protruded. In 21 cases frothy mucus was looked for around the mouth and nostrils, and in 20 or 95·23 per cent. it was found; 91 cases were noted regarding two lines of mucus at the angles of the mouth, and it was present in 23 or 25·57

per cent. The condition of the fingers was noted in 42 of the persons hanged, and they were found to be flexed or clenched in 17 or 40·47 per cent. The condition of the nails was noted in 15 cases, and in every one of them they were found to be of a blue colour. In 92 cases 30 or 32·60 per cent. had vaginal or urethral discharges. Out of 23 cases noted, 8 or 34·78 per cent. had discharge of fæces from the rectum. In 8 cases the condition of the penis was noted, and in 3 or 37·50 per cent. it was found to be erected. The hyoid bone was found fractured in 24 cases or 25·80 per cent. out of total of 93 observed. Notes were made regarding the thyroid cartilage in 64 persons suspended, and of the cricoid cartilage in 11, and in not one of either set of cases was it found to be fractured. Of the 90 cases in which the **coats of the carotid arteries** were observed, in 31 or 34·44 per cent. they were found to be ruptured. In 16 or 51·61 per cent. of these 31 cases, the internal coat, in 4 or 12·90 per cent. the middle coats, and in 11 or 35·48 per cent. both the internal and middle coats, were ruptured.

Questions regarding Hanging.

The chief medico-legal questions connected with death by hanging, are :—I. Was Death due to Hanging? and II. Was the Hanging Suicidal, Accidental, or Homicidal?

I. Was Death due to Hanging?

With reference to this question, it may first be pointed out that in a case of death from hanging, where the period of suspension has been short, or a very soft ligature has been used, there may be no mark at all on the neck. Hence the absence of a ligature mark on the neck does not absolutely contra-indicate hanging as the cause of death.

A ligature mark on the neck does not necessarily indicate suspension of the body (see 'Strangulation,' p. 222); but when due to suspension of the body, it is, as a rule, high up on the neck, oblique, and non-continuous. Suspension of the body, therefore, is indicated by the presence of a ligature mark on the neck, with a force proportionate to the degree of agreement of the mark with these characters. In very exceptional cases, however, a mark, possessing all these characters, may be produced without suspension; *e.g.* when the body has been dragged along the ground, during life or after death, by a ligature round the neck. In such a case, abrasions of the skin due to the dragging will probably be found (see *Case*, p. 155). Suppose, however, suspension of the body to be proved by direct evidence, or strongly indicated by the characters of the ligature mark on the neck, death may yet have been due to a cause other than hanging, and the suspension of the body effected after death. That a ligature mark on the neck, in all respects resembling the mark left by the cord in a case of death from hanging, may be

produced by suspension of the body after death has been amply proved. Casper found that such a mark was produced when bodies were suspended within two hours after death; and Tidy states that an ecchymosed mark may be produced within three, and a non-ecchymosed mark within six, hours after death. This being so, to establish the fact that death was due to hanging, requires not only proof of suspension of the body, but also proof that such suspension was the cause of death. Such proof may be afforded by the presence of the general *post mortem* appearances, already enumerated, of death from hanging. If these are absent, careful search should be made for the presence of signs of death from a violent cause other than hanging. This is extremely important, as murder cases are not infrequently met with in India, in which the murderer suspends the body of his victim after death, with the object of imitating suicidal hanging (see *Cases*, p. 215). In such cases (see first *Case*) the cause of death sometimes is strangulation, and when this is so, the general *post mortem* appearances present may closely resemble those of death from hanging (see 'Strangulation').

II. Was the Hanging Suicidal, Accidental, or Homicidal?

In cases of death from hanging the presumption is always in favour of suicide, even if the body is found only partly suspended. Numerous suicidal cases are on record, in which the body was found partly suspended, with the feet touching the ground, or in a sitting, reclining, or kneeling posture. Powell mentions a remarkable case of this kind (see *Case*, p. 216). Suicide, however, may be negatived by the body being found suspended in such a manner as to show that the individual could not have hung himself. Again, supposing the *post mortem* appearances to show that death was due to hanging, the discovery of an irritant poison, *e.g.* arsenic, in the body but little affects the presumption in favour of suicide. Harvey mentions two cases in which individuals, after having taken arsenic, hung themselves apparently in order to escape the suffering caused by the action of the poison (see, however, *Case*, p. 216). Death being due to hanging, marks of mechanical violence present on the body only positively contra-indicate suicide when the violence indicated is sufficient to have caused immediate insensibility. Mechanical violence short of this, if from its characters self-inflicted, strengthens the presumption in favour of suicide. That suicidal hanging may follow self-infliction of a very severe wound is shown by a case cited by Harvey, in which a man hung himself after inflicting a wound on his throat four inches long, dividing the thyroid

cartilage and œsophagus. Non-self-inflicted violence, not sufficient to have caused immediate insensibility, may be present in a case of suicide, and in fact form the motive leading to it. Age of deceased is important, as children rarely commit suicide.

Accidental hanging is rare. It is sometimes, however, met with, chiefly in cases were children have been playing at hanging. Cases also are recorded where individuals giving a hanging exhibition have been allowed to remain too long suspended, with fatal results. In one case an adult was found accidentally hung in a gymnasium; and a very exceptional case of accidental hanging is mentioned by Ogston (see *Case*, p. 216).

Homicidal cases are also rare.—A few, however, are on record where hanging, pure and simple, appears to have been the cause of death, *e.g.* the three cases mentioned by Chevers, already referred to. In such cases, as a rule, a number of persons are concerned in the murder. A person, however, who is weak, or insensible, or even asleep, may be murdered by hanging by a single other individual. Ogston, for example, mentions a case "where a woman tied a ligature round the neck of her husband while he was asleep, and then pulled him up." Cases are more common where individuals are first rendered insensible (or it may be killed) by mechanical violence, or by strangulation, and then subsequently hung, *e.g.* the Bompard Case in Paris.

The presence of marks of self-inflicted mechanical violence tends, as already pointed out, to strengthen the presumption of suicidal hanging. When marks are present, clearly due to the infliction of mechanical violence by another, such marks may indicate the employment of violence sufficient to have caused (*a*) death, or (*b*) immediate insensibility, or (*c*) insufficient to have caused either of these effects. In case (*a*) the absence of the general *post mortem* appearances of death by hanging obviously confirms the indication of homicide. In case (*b*) the general *post mortem* appearances of death by hanging may be present, but still homicide is indicated. In case (*c*) it is often quite impossible, from the *post mortem* appearances, to arrive at any conclusion as to whether the hanging was suicidal or homicidal.

If strangulation has been employed previous to suspension, evidence of this may be afforded by the presence on the neck, in addition to the mark due to suspension of the body, of marks indicating strangulation (see below). It may here, however, be pointed out that two cord marks on the neck, one

having the characters of a strangulation, and the other those of a hanging mark, may be found in a case of simple hanging, if the cord has been passed twice round the neck.

If very severe injuries are found to have been produced by the cord, *e.g.* laceration of the muscles or other underlining soft parts, the presumption is in favour of homicide or a long drop. Much injury to the soft parts may, however, be met with in suicidal hanging, if the individual has arranged matters so that his body falls some distance before the strain comes on the cord. Homicide is obviously indicated if the body is found suspended in such a manner, or the hands are found secured in such a way, as to show that the individual could not have hung himself.

Strangulation and Throttling.

Homicidal strangulation is easier to commit than homicidal hanging, and it is sometimes falsely alleged by defaulting cashiers and others to screen delinquencies. Accidental strangulation may happen to epileptics and also through the pressure on the throat of high collars, see case below (p. 225).

In strangulation the constriction of the throat is produced by other means than the weight of the body or head. The means used may be fingers (= 'Throttling'), the foot, knee, clothing, etc. Strangulation differs from hanging in that it may be effected without a ligature, *e.g.* by pressure with the fingers, or some hard object. The modes of death in strangulation are the same as in hanging, hence the *post mortem* appearances are also very similar. The main points of difference between the *post mortem* appearances of strangulation and those of hanging are important, as strangulation is usually homicidal, whereas hanging is suicidal.

1. **Mark** or marks on the neck:—
   (1) If a ligature has been used, there will, save in very exceptional cases, be found a mark on the neck. This usually, but not invariably, differs from a hanging mark, in being transverse in direction, low down on the neck, and continuous, *i.e.* completely encircling the neck. In exceptional cases of strangulation, especially if the body has been dragged by the ligature, the mark may be found high up on the neck, and oblique in direction, like a hanging mark. Again, in exceptional cases of hanging, the mark may be found low down on the neck,

and, if the cord has been tightly applied, the mark left by it may be transverse in direction, like a strangulation mark. Abrasions and ecchymoses in the course of the mark, and injury to the underlying soft parts, are much more common in strangulation than in hanging; but the hard yellow brown parchmenty appearance of the skin in the course of the mark is more seldom met with.

(2) Strangulation by manual pressure is tolerably common in India, the victim being usually a child or a female. Where this mode has been employed, marks made by the thumb and fingers are almost invariably found on the neck; sometimes, however, these marks of violence are only visible on dissection. Usually the marks found on the neck in such cases clearly indicate how the strangulation has been effected.

(3) Strangulation by compression of neck with a stick or other hard substance, is often met with in India. Usually, one stick placed across the front of the neck is used; but sometimes two sticks are employed, one placed behind, and the other in front of the neck. This mode of strangulation causes a central bruise on the front of the neck, and usually severe local injury such as fracture of the cartilages or hyoid.

2. **Asphyxial** and other appearances.—The lungs, as in hanging, may be found uncongested. According to Tardieu, patches of emphysema on the surface of the lungs, due to rupture of the superficial air-cells, are invariably, and apoplectic effusions into the substance of the lungs commonly, present in death from strangulation; while punctiform sub-pleural ecchymoses ('Tardieu's spot'), common in suffocation, are rare in strangulation. But Professor Powell's unique experience shows that Tardieu's statements are more emphatic than warranted, as patches of emphysema are *not* invariably found. And ecchymoses are *not* rare in strangulation, or in hanging.

Saliva running in straight lines down the chin and chest, a common appearance in death from hanging, is not likely to be present in strangulation.

In three cases reported by Dr. Mackenzie, in none of them were the appearances in the air-cells of the lungs or about the skin of the face, neck and chest and conjunctiva mentioned by

Tardieu found. In all these cases the eyes were closed. In none of them were muscles or other deep structures of the neck injured. In these cases the tongue was not swollen; in two it was protruded between the teeth and was bitten into but not through. In none were the fingers clenched.

Questions regarding Strangulation.

As in hanging, the chief medico-legal questions connected with death by strangulation, are: I. Was Death due to Strangulation? and II. Was the Strangulation Homicidal, Suicidal, or Accidental?

I. Was Death due to Strangulation?

It may first be pointed out, that in very exceptional cases, death may occur by strangulation, without any mark being present on the neck. This may happen if a soft ligature has been used. It rarely, however, occurs, as even when a soft ligature is employed, much superfluous violence is commonly applied, and a distinct mark on the neck is usually present. If no marks of violence, either external or internal, are to be found on the neck, strangulation is very strongly, but not positively, contra-indicated. When strangulation has been effected by means other than the use of a ligature much violence is almost always used—often to other parts of the body as well as the neck—and there is seldom any difficulty in arriving at a conclusion as to the cause of death. Here, however, it must be remarked, that in very exceptional cases of death from natural causes, finger-marks may be found on the neck, accompanied by the *post mortem* appearances of death from asphyxia. An individual dying from asphyxia the result of disease, *e.g.* epilepsy, may, in his struggles for breath, by clutching at his throat, produce such marks. Hence, if the only marks of violence present on the body are slight finger-marks on the neck, a guarded opinion must be given as to the cause of death.

Case.—**Strangulation.** (? Suicidal); finger-marks on the neck probably caused by deceased himself.—A man was found dead in the house of a prostitute, who had been his mistress for three years. Deceased's cousin was sleeping in the same house with another prostitute, and was called early in the morning by deceased's mistress, who appeared to be much alarmed at his (deceased's) condition. The cousin found him apparently dying, and removed him to his own house. A *post mortem* examination was made, and showed death to be due to *apnœa*. Three marks were found on deceased's throat such as would be produced by finger-nails. The surgeon who made the examination thereupon reported strangulation to be the cause of death, and deceased's mistress was tried and convicted of the murder. It, however, appeared that deceased had been subject to

epileptic fits, and many of the circumstances of the case being strongly against the supposition of homicide, the High Court reversed the conviction, holding that the marks on the throat might have been produced by deceased himself.—Chevers, *Med. Jur.*, p. 580.

Ligature mark on the neck, corresponding in external appearance to a strangulation mark, cannot of itself be taken as evidence of death by strangulation. Such a mark may be the result of the application of a ligature to the neck after death, or have been accidentally produced by the pressure of a tight-fitting article of dress, or be the result of putrefactive swelling against a string tied loosely round the neck. In the last two cases, however, injury to the underlying soft parts, common in strangulation, is not likely to be found. Hence, even when a ligature mark is found on the neck, corresponding in appearance to a strangulation mark, to establish the fact that death was due to strangulation, requires proof that the pressure of such ligature was the cause of death. Such proof may be afforded by the presence of the general *post mortem* appearances of death by strangulation. It must, however, be recollected that in hanging, as well as in strangulation by a ligature, death is due to the pressure of a ligature on the neck. Further, that in hanging the presumption is always in favour of suicide, while in strangulation it is in favour of homicide. Hence, in all cases of death from pressure of a ligature on the neck, all appearances indicating the cause of death to be hanging, rather than strangulation, or *vice versâ*, should be most carefully noted.

II. Was the Strangulation Homicidal, Suicidal, or Accidental?

Accidental cases are rare: a few, however, are on record.

Case.—**Accidental strangulation by bonnet-strings.**—Elizabeth Kenchan, an extremely dissipated, drunken, and disorderly woman, went to bed intoxicated with her bonnet on, and in the morning was found strangled in its strings. She had fallen out of bed, her bonnet became fixed between the bedstead and the wall, and she, being too drunk to loosen the strings, was strangled.—Guy, *For. Med.*, p. 262.

Case.—**Accidental strangulation by neckerchief.**—A man was carried to bed very drunk, and left there with his clothes on. It was supposed that afterwards he had got up so far as to lean over the front of his bed to vomit, with his hands pressed on the pit of his stomach, as he was found dead in this posture in the morning. His neckerchief was so tight around his neck that the contraction thus caused would have sufficed to produce strangulation, from his inability to change his position, in the helpless condition he was in at the time. The inspection, by presenting all the appearances which were to have been expected under such circumstances, left no doubt but that accidental strangulation was the cause of death.—Ogston, *Med. Jur. Lect.*, p. 543.

Case.—**Accidental strangulation by basket-strap.**—A girl was accidentally strangled in the following manner: She was employed in carrying fish in a basket at her back, supported by a leather strap passing round the front of her neck above her shoulders. She was found dead sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap which had firmly compressed the windpipe.—Taylor, *Med. Jur.*, II., p. 67.

Case.—**Accidental strangulation by high collar.**—A gentleman farmer, W. H., of Kingscliffe, near Peterboro, died yesterday of strangulation during a heart-seizure through his throat falling forward on his high collar and causing asphyxia. Major G. P., of Pimlico, died in November last under similar circumstances.—*Daily Express* (London), Jan. 28, 1920.

Suicidal cases of strangulation by a ligature are sometimes met with. To effect suicide in this way requires the employment of some means whereby the ligature is kept tight, independently of any muscular effort on the part of the suicide; so that relaxation may not occur when insensibility supervenes. This end may be arrived at in various ways, *e.g.* by simply passing the ligature more than once round the neck; or, by securing the ends of the ligature to the foot, or to the wrists in such a manner that the ligature is tightened when the arms are extended; or to some fixed object. Or, it may be arrived at by twisting a stick in the tied ligature, and securing the end of the stick; or by simply knotting the ligature. As regards this last method, it may be noted that the presence of more than one knot raises a suspicion of homicide; two knots have, however, occasionally been found in suicidal cases; more than two knots very strongly indicates homicide.

Homicidal cases.—Just as in hanging the presumption is always in favour of suicide, so in strangulation the presumption is in favour of homicide. Homicide is very strongly indicated, (*a*) when a ligature has been employed, by the absence of evidence indicating the use of some means for the purpose of keeping it tight after insensibility has occurred; (*b*) by the presence of signs indicating the application of much violence to the neck or to other parts of the body, and (*c*) when the strangulation has been effected by means other than the use of a ligature. Obviously homicide also is almost conclusively indicated if the hands are found tied together in such a way as to show that they could not have been so secured by the individual himself.

Case.—**Homicidal strangulation.**—On April 4, 1888, Shaikh Haru left his home in good health, and the same evening his body was found tied up in a box, and Mihir Ali, of the Doveton Institution, was suspected of the crime. At the *post mortem* examination, made on the day of the death, the body was found tied by means of three cords, one made

of jute, another of hemp, and a third of cotton. Thighs flexed on the abdomen, the legs on the thighs, the knees resting on the left side, and middle of the chest 3½ inches above the left nipple. Left arm was tied above the wrist to the left leg, 10 inches below the left knee. Right arm was tied to the right thigh 6 inches above the right knee. The *first* cord was of jute. It was about ½ inch in diameter; it was tied round the lower part of the neck, the knot was double; it was tied on the front of the lower part of the neck just above the manubrium of the sternum. It was then carried downwards over the middle of the chest behind the knees, then upwards along the left side of the chest round the back of the lower part of the neck, then downwards along the right side of the chest to the right wrist, where it was tied to a narrow hempen cord. The *hempen* cord was ⅛ of an inch in diameter; at its commencement it was double; it passed from the back of the right wrist downwards for about 3 inches to the middle and outer side of the right thigh; it then passed backwards round the lumbar region to the back of the left elbow. At this place the cord became single; it then passed round the left forearm, 3 inches above the back of the left wrist, then across the middle and front of the right thigh, and was tied here to a part of the same cord, where it was turned backwards round the lumbar region. The *third* cord was made of soft cloth; it was twisted round into two ply, and then doubled. It was tied tightly round the lower part of the neck; the colour of this cord was white, with a streak of pale red and another streak of light pale blue in it. It was tied tightly round the lower part of the back of the neck by means of an ordinary double knot. This cord was beneath the jute cord. An abrasion 3 inches long and ⅛ of an inch broad on the right cheek extended outwards from the right angle of the mouth. The abrasions of the lips and abrasion at the right angle of the mouth and on the right cheek had the appearance as if a gag had been applied to the mouth. The other signs of strangulation were present. OPINION: that the deceased died from asphyxia, due to strangulation. Mihir Ali was found guilty of murder, and sentenced to be hanged; but his sentence was commuted by the Government to transportation for life.—Dr. Coull Mackenzie, *Ind. Med. Gaz.*, 1888, p. 232, etc.

Case.—**Homicidal strangulation.**—A *gharami*, or thatcher, named Gopal Bairagi, eloped from his native village in the Birbhum district with a young woman named Bow, and the pair came to Calcutta and lived as husband and wife. The neighbours said they frequently quarrelled. On the night of the 8th July, 1878, they retired to bed, and on the next morning the man could not be found, and the body of the woman covered with a quilt and a gunny bag, her mouth gagged with a piece of cloth, and a coir rope tied tightly round her neck. The body, examined on the 9th July, showed a mark of a cord round the neck immediately below the thyroid cartilage and a contusion of the left eyeball. A piece of cord was twisted twice tightly round the mouth and a double cord made of two twists of thin coir rope tied tightly across the middle of the neck. The skin beneath this cord was parchment-like. There was no extravasation of blood beneath the skin or into the muscles of the neck, nor injury to the muscles of the neck or to the wind-pipe. OPINION: that the deceased died from asphyxia due to strangulation. Gopal Bairagi, after some months, returned to his native village, where he was apprehended. He was tried at the High Court and acquitted, as the only evidence against him was circumstantial, which the majority of jury (natives) would not rely on.

Suffocation.

Under 'Suffocation' are included all cases of asphyxia (drowning excepted) caused by violent means other than direct pressure on the wind-pipe, as for example:—(1) By closing the mouth and nostrils; (2) by pressure on the chest; (3) by blocking of the lumen of the glottis or air tubes; and (4) by an atmosphere deficient in oxygen.

1. **Closing the mouth and nostrils.**—This may be (*a*) Homicidal, as in cases of infanticide effected by closing the mouth and nostrils with the hand. The mouth and nostrils in homicidal cases also may be closed by plasters applied to the face; this was the way in which the resurrection men, Burke and Hare, murdered their victims in Edinburgh. Burke, after conviction, confessed to sixteen murders effected in this way in a few months. Again, soft pillows may be employed, as in the case of the two princes murdered in the Tower of London. (*b*) **Accidental,** as in cases where children are accidentally smothered by their *mothers* **overlaying** the infants in bed. (*c*) **Suicidal.**—Cases of suicide effected in this way are extremely rare. Taylor, however, mentions a case of a woman who is reported to have committed suicide by simply leaning with her mouth and nostrils pressed against the bedclothes.

2. **Pressure on the chest.**—Suffocation caused in this way is generally accidental, usually occurring from either accidental smothering by burial under the *débris* of fallen buildings, earth, etc.; or pressure in a crowd, as in the case which occurred in Paris in 1837, in which twenty-three persons were suffocated in this way in a crowd in one of the streets. A case also is recorded of a man who, while a plaster cast of his trunk was being taken, was nearly killed by the pressure on his chest of the solidifying plaster. Homicidal cases are sometimes met with in India. In homicidal cases, if the victim is an adult, and was not first rendered insensible, or was not a consenting party, probably several persons will be found to have been concerned in the murder. Often great violence is used, sometimes causing symmetrical, or nearly symmetrical, fractures of the ribs (see p. 127). In children great violence may be employed, sufficient, in fact, to cause extensive injury to the lungs without fracture of the ribs. Under the head of homicidal suffocation by pressure on the chest may also be mentioned (1) the burial alive of widows with their husbands' body, a custom formerly prevailing, to a certain extent, in India; and (2) the *samádh* or burial alive of lepers—often with the consent

or at the entreaty of the victim—cases of which used formerly to be not infrequently met with in India. Suicidal suffocation by pressure on the chest is hardly possible.

3. **Closure of the glottis.**—Suffocation thus caused often occurs accidentally from the impaction of foreign bodies—masses of food, for example—in the throat or air passages, often by pieces of food during an inspiratory act whilst vomiting, especially if drunk or under the influence of chloroform, or by swallowing false teeth, etc., or from spasm of the glottis, the result of disease or of the inhalation of poisonous or irrespirable gases. Powell reports a case of this sort by impaction of a round worm in larynx. Suicidal suffocation by closure of the glottis, effected by forcing rags, articles of dress, etc., into the fauces is sometimes met with. Homicidal cases are rare in adults. Children, however, are sometimes murdered by filling their mouths with mud or other soft material.

4. **Deficient Oxygen**, such as the fumes of wine or beer vats, or bursting of the carbonic acid pipes in a refrigerator.

Post mortem appearances in death from suffocation.

1. **Appearances of asphyxia.**—Cases, however, have occurred of undoubted death from suffocation, where most of the *post mortem* appearances of asphyxia were absent. On this point Christison, in the case of the woman Campbell, murdered by Burke the resurrectionist, remarked, "the conviction in the public mind that a well-informed medical man should always be able to detect death by suffocation, simply by an inspection of the body, and without a knowledge of collateral circumstances, is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly marked appearances in every case of death from suffocation. That such appearances are very far from being always present, ought to be distinctly understood by every medical man."

2. **Punctiform sub-pleural ecchymoses,** or 'Tardieu's spots' (p. 221 and below), are usually present in cases of suffocation. Powell reports two large apoplectic effusions in a child whose death was caused by plugging the larynx with a rag.

3. **Appearances of violence** sufficient to cause suffocation, *e.g.* marks of violence on the chest, marks indicating the application of manual pressure, or of plasters over the mouth

and nostrils, foreign bodies impacted in the throat, etc. Cases, however, of death from suffocation by violence may occur, and no appearance of this class be present.

Questions regarding Suffocation.

As in hanging and strangulation, these are:—I. Was Death due to Suffocation? and II. Was the Suffocation Accidental, Suicidal, or Homicidal?

I.—Was Death due to Suffocation?

The chief points bearing on this question are:—

1. **The signs of asphyxia** may be nearly **absent**, and yet death may have been caused by suffocation (see Christison's remarks just quoted).

2. **The signs of asphyxia** may be **present,** and those of drowning, hanging, and strangulation absent, and yet death may not have been the result of suffocation by violence, but may have been due to asphyxia, the result of disease, or poison, *e.g.* epilepsy, tetanus, or strychnia poisoning. Hence, in cases of alleged suffocation by violence, much depends on the presence or absence of signs indicating the employment of violence, such as would produce suffocation. If these are absent, no positive opinion can be given, from the *post mortem* examination alone, as to the cause of death.

3. **Tardieu's spots** (p. 213). If these are numerous, well defined and limited in size, on the lungs and thymus gland they contra-indicate strangulation, and indicate suffocation to be the cause of death. Their presence, however, is consistent with death from causes other than suffocation. They have been met with in the bodies of adults after death from drowning, hanging, strangulation, scarlatina, heart-disease, apoplexy, pneumonia, and relapsing fever. They are almost the rule in plague. They are also found in the bodies of still-born, and even unborn, infants. Further, their absence does not, at any rate in the case of adults, conclusively contra-indicate suffocation. Ogston failed to find them in nine cases of death from suffocation in adults.

II.—Was the Suffocation Accidental, Suicidal, or Homicidal?

1. **If the deceased** is an adult, the presumption is always in favour of accident. Curious accidents leading to suffocation

by closure of the glottis sometimes occur. Suicidal cases are rare, but are sometimes met with, *e.g.* the case of suicide by closure of the mouth and nostrils already referred to above, p. 228. A case also is reported in which a prisoner committed suicide by stuffing his mouth with rags, another in which a young woman suffocated herself by stuffing a large ball of hay into her throat, and another of a young woman who committed suicide by shutting herself up in a trunk. Homicidal cases are not often met with. In a homicidal case, unless the victim was suffocated while insensible, marks showing the employment of much violence will probably be found.

Case.—**Accidental suffocation by plums.**—Dr. Mackenzie relates that of a native female child of about four years of age, who, while playing about under a country plum tree, ate a quantity of its unripe fruit, and was shortly seized with a severe attack of vomiting. The parents took her to a native practitioner, who, after giving some medicines, recommended that she should be removed to hospital, but on arrival the child was dead. The body, examined the next day, was found well-nourished with no external marks of violence. The finger nails were of a blue colour, the eyes not sunken, and the skin of the fingers and toes not shrunken. The lungs, the liver, the spleen, the kidneys, and the vessels of the brain were congested. The heart was healthy, the right side full of dark fluid blood, the left side empty. The stomach, the intestines, the bladder, the uterus, the ovaries, the vagina, and the substance of the brain were healthy. The larynx, trachea, aud large bronchi were full of half-digested green plums, and the stomach contained a quantity of half-digested green plums. The intestines contained well-formed fæces and half-digested green plums. No bones were fractured. OPINION: That the child died from suffocation owing to the half-digested green plums passing into the air passages during a deep inspiration while in the act of vomiting.—*Ind. Med. Gaz.*, 1890, p. 295.

Case.—**Accidental suffocation by meat.**—A European sailor, J. K., who had been drinking heavily, while eating a mutton chop began to vomit and suddenly became insensible. He was removed to hospital, but on arrival was dead. Post-mortem a piece of the chop, $3\frac{1}{2}'' \times 1''$, was found firmly wedged into the entrance of the larynx.

Case.—**Suffocation in a Chest.**—A sweeper in the Byculla Club. Bombay, in the habit of sleeping in a wooden trunk, was found dead of suffocation in 1916. The lid, which was almost vertical when open, had accidentally fallen down and the hasp had become fastened.—Prof. Powell's *Reports*, 1917.

Case.—**Accidental suffocation.**—"In 1850, Dr. Whyte reported the case of a strong Madras water-carrier into whose mouth a fish had jumped while he was bathing. On opening the mouth, the tail of a large cat-fish presented itself, with the body firmly fixed within the fauces, and filling up the isthmus completely. It had entered flat, so that the fin of one side was posterior to the velum, and opened out on any attempt being made to withdraw the fish. The operation of œsophagotomy was commenced and was abandoned. A piece of cane was made into a probang, and, with it, attempts were made to press the fish downwards into the

œsophagus. It did pass downwards, when the patient at once ceased to breathe, gave one convulsive struggle and died to all appearance. The trachea was immediately opened, and respiration was restored. In the course of the night the man coughed up the fish, the fins having become softened by decomposition."—Chevers, *Med. Jur.*, p. 619.

Case.—**Accidental suffocation.**—"In 1865, a native boy about four years old was brought to the Calcutta Medical College Hospital, with a *coir* fish impacted in his glottis. These fish are very tenacious of life out of water. The poor child appears to have taken up the fish, and to have put its head into his mouth. In its struggles, its head passed the glottis, and all attempts to withdraw it were prevented by the catching of its gill-plates, anchor-wise, below the vocal chords. The child was suffocated."—Chevers, *ib.*, p. 619.

Case.—**Accidental suffocation.**—"A private soldier, *æt.* 28, was discovered, at night, by the man lying next to him to be breathing loudly and with great difficulty, as if there were some obstruction about the lower part of the trachea. He was at once removed to the dispensary, where he died in about fifteen minutes. Several small pieces of potato were found in both bronchial tubes, where these subdivided into small branches. There was great œdema of the glottis, no doubt from the irritation caused by a foreign body. The deceased had drunk some beer and also rum in the course of the evening, before retiring to rest. He had been sick, and had vomited while in bed."—Chevers, *Med. Jour.*, p. 618.

2. If the deceased is a child or infant suicide is, of course, contra-indicated, and the question lies between accident and homicide. Accidental cases often arise from **overlaying,** or from accident during birth (see 'Infanticide').

Fatal overlaying of infants by parents in bed through carelessness occurs chiefly amongst the poor, and is rare after nine years of age, as the child is then strong enough to extricate itself. In suspected overlaying the death may sometimes be due to fatal teething or cerebral convulsions during the night. In addition to marks of suffocation, marks of pressure on the body or face should be looked for, *e.g.* a flattened nose. Cases are reported by Dr. Westcott, coroner of N.E. London (*Trans. Med. Leg. Soc.*, I. 1903, 44), of overlaying of infants by the domestic cat and by the infant burying its face in a pillow.

Homicidal suffocation is sometimes met with in children, and frequently met with in infants, by stuffing the mouth with rags, or filling it with cowdung or dirt, these being common modes of infanticide in India.

Case.—**Homicidal suffocation.**—A lad from thirteen to fifteen years of age was sentenced, at Agra, to transportation for life for having robbed a girl of four, his near relative, of her ornaments after having filled her mouth with *bhusa* (bran). The civil surgeon deposed that death had

been caused by suffocation, consequent upon the mouth of the deceased being filled with *bhusa*.—Chevers, *ib.*, p. 616.

Case.—**Homicidal suffocation.**—An old woman of Tirhut, finding a little girl of six digging up some grain from her field, felled the child with a heavy clod, and then suffocated her by pressing her clothes against her mouth until she ceased to breathe. She then stripped off the clothes and ornaments, and buried the corpse.—Chevers, *ib.*, p. 616.

Case.—A girl aged about twelve. Body far advanced in decomposition; no marks of violence externally, but on cutting into the skin of the chest, extensive bruises and bloody effusions were found over the whole front aspect of the ribs. The ribs were not fractured. The right lung was natural, but the left had been most severely injured by compression and had become a jelly-like mass. The girl had probably been thrown down, and then had her chest compressed by the weight of her assailant's body. —Dr. McReddie, in McLeod's *Beng. Med. Leg. Rep.*, 1868-69, p. 36.

Drowning.

This mode of violent death from asphyxia is by submersion of the mouth and nostrils under water or other fluid, so that access of air to the lungs is cut off. This form of asphyxial death differs from the other forms, in that water or other submersing fluid is drawn into the lungs during attempts at respiration.

Causes.—Accidental cases are common among the sea-faring population of the coast and inland, especially among females, from falls into wells and tanks.

Suicidal cases are also common in India. In the Madras and Bombay presidencies, over three-fourths of the female and nearly one-half of the male, suicides drown themselves. In European countries also, drowning is a mode of suicide often selected, ranking, as a rule, second in order of frequency. In Dr. Mackenzie's 305 cases of drowning at Calcutta, only 2·62 per cent. were suicidal, the reasons assigned being family disputes, insanity, and bodily disease. Homicidal cases are rare, but are sometimes met with in India. Dr. Mackenzie had only one such out of 305 cases.

Mode of Drowning.—When a person falls into water he sinks, but usually, if not stunned, rises again to the surface, probably by the movements of his limbs, and tries to breathe, in which case death occurs by asphyxia. In his struggle, he takes in some water, which striking the glottis causes cough and forcible expiratory efforts, and the raising of a portion of his body out of the water, causing him to sink a second time.

He may again rise to the surface by the movements of his limbs, again struggle, and sink. Ultimately, in consequence of the expulsion of air from the lungs, and the specific gravity of the body being greater than that of water in the proportion of 1·08 to 1, the body ceases to rise. The subjective sensations are said by the resuscitated to be mental confusion followed by pleasing dreams. Where the person sinks at once and does not rise again during life, death is due to 'inhibition' or some precedent condition, *e.g.* syncope, epilepsy, etc.[1]

Submersion of the whole body is not necessary for drowning, as drunkards, epileptics, and children have been drowned in shallow puddles or vessels containing only a few inches of water.

Case.—**Drowning in shallow water.**—Dr. A. Powell gives these two cases:—Patu m., *æt.* 20, liable to epileptic fits, for which he had been under treatment at intervals for two years, went to work in some muddy rice land on 14th May, 1890. An hour later he was found dead, lying with his face downwards in a shallow pool. The water was so shallow that only his mouth, nose, and the right side of his face were immersed, the left eye and side of face being above the surface. The rest of his body from the neck downwards was on dry ground. *Post mortem.*—The mouth, nasal cavities, and air passages contained mud and green water weeds.—*Ind. Med. Gaz.*, 1897, p. 300.

Case.—Mazli, *æt.* 26, attended in hospital for epilepsy. On August 23, 1890, she was found dead, face downwards in an almost dry drain. I measured the depth of the water at once and found the maximum for some distance to be 2 inches, except a depression of 3½ inches where her head had lain. *Post mortem.*—Air passages contained sand and muddy waters with a few blades of grass; skin of face soddened *à la blanchisseuse;* elsewhere *cutis anserina* marked. Uterus contained an eight months' fœtus.

For other two cases see Appendix.

Mode of death.—In the great majority of cases death is due to asphyxia. Almost all the balance is due to inhibition or syncope. Apoplexy, if by this is meant cerebral hæmorrhage, is most rare, and if prominent would be the cause of death and not drowning. Excitement, whether due to a struggle against drowning or against an enemy in a fight, or trying to catch a train, will make a diseased artery give way and cause apoplexy.

In Dr. Mackenzie's 305 cases, 297 or 97·37 per cent. persons died from asphyxia; 1 or 0·32 per cent. from syncope; 1 or 0·32 per cent. from asphyxia and apoplexy, and in 6 or 1·96 per cent. the mode of death could not be ascertained, on account of the bodies being in a very advanced state of putrefaction.

Period at which death takes place.—This varies with the mode of death. It is instantaneous if from shock, rapid if

[1] F. Crookshank, *Trans. Med. Leg. Soc.*, 1910, 13-21.

from pure asphyxia, less rapid if from a combination of asphyxia with syncope or cerebral congestion. When death occurs from pure asphyxia, asphyxia commences as an outside limit after two minutes' complete submersion, and death takes place within five minutes. Recovery is rare after five minutes' complete submersion.

The longest record dive under water is 4 minutes 45½ seconds by Miss E. Wallenda in a tank at the Alhambra Music Hall, as tested by expert timekeepers.—*Whitaker's Almanack.*

Treatment should, however, be persevered with, until it is certain that death has taken place, (*a*) because in exceptional cases animation has been restored after more than five minutes' complete submersion, (*b*) because the submersion, although alleged to have been complete, may not have been so, and (*c*) because by persevering treatment, individuals have been recovered, who have shown no signs of animation for several hours; in one case of recovery it is said that there were no signs of animation for 8½ hours.

Period at which dead body floats.—The body eventually comes to the surface, if not entangled, when putrefactive gases make it sufficiently light to float. The length of time for this varies with the temperature of the air, water, the sex, etc. Fat bodies float sooner than thin. In hot weather a body may float within 24 hours after drowning, but it is seldom possible to estimate from the bodies the length of time since death.

In the Hughli river at Calcutta Dr. Mackenzie found that if there was no obstacle to impede the rising of bodies they generally floated in the hot and rainy season within 24 hours of the immersion, and in the cold season in from two to three days.[1] In Dr. Mackenzie's 305 cases, in 138 or 45·28 per cent. putrefaction was present; in 5 or 1·63 per cent. the bodies were saponified; in 124 or 40·65 per cent. the bodies were fresh; and in the remaining 38 or 12·45 per cent. no note was made as to their condition.

Case.—**Buoyancy of decomposed body.**—A woman was killed on the night of a Friday, and the evidence went to show that the body must have been thrown into a well about midnight. On the following Sunday morning, about meal-time, which was about 8 or 9 A.M., the body was found floating with a heavy stone attached to it. The woman was said to have been of slight figure and short stature, and therefore probably, when alive, did not weigh more than 100 to 105 lbs. The stone itself weighed 92 lbs., so that the decomposition in 30 hours must have been so rapid as to generate gas capable of raising, not only the body itself, but the dead-weight attached to it. The stone was attached to the waist, and the body, when

[1] *Ind. Med. Gaz.*, 1889, 131. See also Art. by Prof. Powell in *I. M. G.*, 1904.

found, was lying horizontally on the surface of the water on its side. The water was from ten to twelve feet in depth, and the specific gravity of the stone was 2·7. This case is of interest, as showing the extreme buoyancy of a decomposed body in water, and the rapidity with which gases can be generated. The murder occurred in September, 1883.—Gribble, *Med. Jur.*, p. 99.

Treatment of Apparently Drowned Persons.

Attempts at resuscitation should be commenced at once. First get rid of any water in the mouth, and upper air passages, etc., by placing the body for a few seconds, face down, with the head a little lower than the feet, keeping the mouth open, and the tongue drawn forwards. Next turn the body on the back, as quickly as possible, strip it, rub it dry, and apply warmth

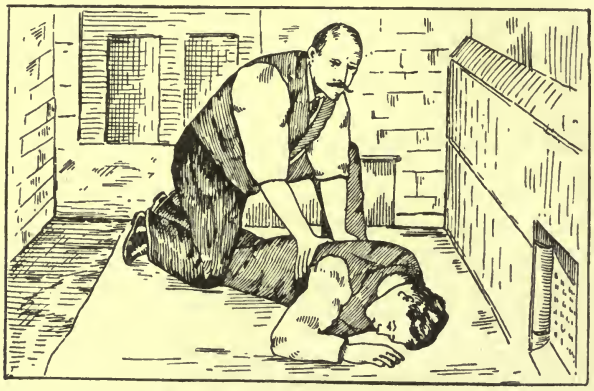


Fig. 21.—Schæfer's Mode of resuscitating the Apparently Drowned.

to the surface, and weak ammonia or snuff may be held to the nostrils by some other person. If respiration is not restored, commence artificial respiration immediately.

Artificial respiration.—The best and easiest method of performing artificial respiration is **Schaefer's.** It is safer, more efficient, and easier to apply than the older methods of Marshall Hall (prone pressure and rolling), of Howard (supine pressure), and of Silvester (forcible traction on the arms, followed by bringing these back to the side of the chest, and pressure on the chest). In the Schæfer method,[1] amongst other advantages, the face of the person being placed downwards the tongue falls

[1] E. A. Schæfer, in *Medico-Chirurg. Trans.*, 1904.

downwards and out of the way of the wind-pipe whilst water and mucus run out, and the muscular exertion required by the operator is very much less than in the other methods. Its mode of application will be seen from the illustration.

Directions.—Instantly on removal from the water place the patient face downwards on the ground with a rolled-up coat under the lower part of the chest so that the head hangs down, and the patient's arms bent and placed under his forehead to keep nose and mouth clear of the ground. The operator puts himself athwart the patient, or kneels by his side facing his head. Then place your hands flat over the lower part of the back (lowest ribs), one on each side, and gradually throw the weight of your body forward on them so as to produce firm pressure, which must not be violent, on the patient's chest. By this means the air (and water, if there is any) is driven out of the patient's lungs. Immediately thereafter raise your body slowly so as to remove the pressure, but leaving your hands in position. Repeat this forward and backward movement (pressure and relaxation of pressure) every four or five seconds. In other words, sway your body slowly forwards and backwards upon your arms twelve to fifteen times a minute, without any marked pause between the movements. This course must be pursued for at least half an hour, or until the natural respirations are resumed. If they are resumed and, as sometimes happens, again tend to fail, the process of artificial respiration must be again resorted to as before. Whilst one person is carrying out artificial respiration in this way, others may, if there be opportunity, busy themselves with applying hot flannels to the body and limbs, and hot bottles to the feet; but no attempt should be made to remove the wet clothing, or to give any restoratives by the mouth until natural breathing has recommenced. Hypodermic injections of atropine sulphate ($\frac{1}{100}$th to $\frac{1}{50}$th grain), and of supra-renal extract (either as adrenalin chloride or in any other form) may be used to assist recovery.

When spontaneous breathing returns, apply heat by water-bath or friction, and when swallowing returns give a little brandy and water. This treatment should be persisted in for several hours—flushing and convulsive twitchings of face and gasping indicate returning breathing. The prospect of resuscitation is better when the cause of apparent death is inhibition than in asphyxia.

Questions regarding Drowning.

The chief medico-legal questions connected with drowning, which must be kept in view when making the examination, are:—(1) Is life extinct? (2) The *manner* and cause of death. What is the probable cause of death, was it Drowning, or some other cause operating before immersion? and (3) Was the Drowning Accidental, Suicidal, or Homicidal? The first question is answered under the 'Signs of Death.'

II. Was Death due to Drowning or to some other cause operating before immersion?

Signs of drowning in body.—The external signs will vary according to length of time the body has been submerged. As in 87·5 per cent. of cases of death from drowning, the mode of death is asphyxia, pure or mixed, the *post mortem* appearances of death from asphyxia will usually, but not invariably, be found. Thus usually the right side of the heart will be full, and the left side empty, and the lungs and venous system engorged. Great congestion of the lungs, especially if accompanied by sub-pleural ecchymosis, indicates that the struggle for life has been great. Whether, however, the *post mortem* appearances of apnœa are present or not, other appearances indicative of death from drowning must be searched for, because (*a*) asphyxia, if present, may have been the result of causes other than drowning, and (*b*) the mode of death may not have been apnœa, and yet death may be due to drowning.

Post mortem signs other than those of asphyxia which indicate death by drowning are as follows:—

Externally.

1. **Froth in the mouth and nostrils.**—This froth, like fine '*shaving lather*,' although usually present in death from drowning, disappears soon after the body is removed from the water. It is often also present in death from causes other than drowning, *e.g.* in epilepsy, and in cases of death from asphyxia not due to drowning.

2. **Cutis anserina,** or goose-skin, if present, indicates that immersion took place either during life or shortly after death; no conclusion can however, be drawn from the absence of this appearance: Powell points out that it is due to contraction of the erector muscles of the hairs and that it disappears with *rigor mortis*, which is usually early.

3. **Retraction of the penis.**—This is the result of cold, terror and arduous struggling, and is frequently found in cases of drowning; it may be absent in tropical waters; the colder the water, the more marked is the shrinking.

4. **Sand,** mud, weeds, sticks, etc., grasped in the hands or sticking under the nails, are evidence of struggles in the water during life, and hence presumptive evidence in favour of death having been caused by drowning; abrasions on skin, especially hands.

Internally.

1. **Water in the stomach,** especially if this contains matters such as are present in the water of immersion, *e.g.* algæ, diatoms, etc. Water is usually found in the stomach if the individual was sensible at the time

of immersion. It is highly improbable that after death, water can enter the stomach, hence the presence of this *post mortem* appearance indicates it to be highly probable (*a*) that the individual was sensible at the time of immersion, and (*b*) that as a consequence death was due to drowning, though not necessarily negativing either of those probabilities absolutely. Powell found water in the stomach in about 60 per cent. of cases of drowning.

2. **Water in lungs.**—The lungs are distended with indrawn water and full of bloody froth in bronchi, so that, Powell points out, the distended lungs feel sodden and œdematous and do not collapse on opening the pleura. Water may transude into the pleural cavities.

3. **Mud**, sand, or floating matters mixed with water in the lungs or wind-pipe.—This is evidence of even greater value than the last-mentioned appearance in favour of the supposition that the individual was sensible at the time of immersion, and that, therefore, death was most probably due to drowning.

In conclusion, it must be remembered that in many cases where death is undoubtedly due to drowning, *post mortem* evidence may be indefinite or altogether absent. In such cases, it is the duty of the pathologist to say he has found no evidence, or no definite evidence of drowning, but that such finding is consistent with death from drowning. In many such cases where no lay evidence is forthcoming juries usually give the verdict of "Found Drowned." A more logical verdict would be "Found dead in the water." As decomposition advances *cutis anserina*, froth in the nostrils, froth and water in the lungs, and water in the stomach successively disappear. The penis and scrotum become ballooned with emphysema. Hence, in all cases of suspected drowning, the *post mortem* examination should be held at the earliest possible opportunity.

It should be noted that the *post mortem* appearances of death by drowning may be altogether absent, and yet drowning may have been the cause of death. In such case the absence of appearances indicative of death from a cause other than drowning, *e.g.* violence, poison, or disease, must be ascertained by careful search.

III. Was the Drowning **Accidental, Suicidal, or Homicidal?**

Death from drowning is, as above noted, usually accidental, more seldom suicidal, and rarely homicidal, except in infants. The fact, however, of the body being found in water does not necessarily imply death from drowning, as the person may have been murdered first and afterwards thrown into the water. Thus the body found in water should always first be examined for marks of violence. On the other hand, some suicides inflict

wounds on themselves before drowning and have even tied their feet together and weighted their bodies with stones, etc. Valuable indication of insanity or otherwise may be obtained from papers or notes in the clothing. (N.B.—Sodden papers should be unfolded in water and *not* first of all dried.) Sometimes no indications are afforded as to whether accidental or suicidal.

1. **Marks of violence** on the body.—All cuts, bruises, or abrasions should be especially examined, as the presence of inflammatory action indicates an injury received sometime before death. Very often such marks are due to accidental injury at the time of immersion, or, but less often, to injury after immersion. Hence, in a case of death from drowning such marks do not indicate homicide, unless from their nature or from the circumstances of the case, the possibility is excluded of their being due to: (*a*) injuries received at the time of immersion, owing to the body striking in its fall against some hard object, or if the fall had been from a great height against the surface of the water. Bodies found in wells frequently exhibit severe injuries caused in the first of these two ways; and fracture and dislocation of the cervical vertebræ have resulted from the head striking forcibly against the bottom of a shallow bath. Again, a case is recorded in which dislocation of both arms backwards was caused by the body after falling from a great height striking the surface of the water with the arms outstretched. (*b*) Injuries received after immersion, during life or after death, *e.g.* a case is reported where a mark of a ligature on the neck was produced by the string of a cloak getting tightly drawn round the neck during the struggles of the drowning person; and another where fracture of one of the cervical vertebræ was caused by the muscular effort of throwing the head violently back on contact of the body with the water. Obviously also severe injuries may result from the body during life or after death being forcibly dashed against some hard object, *e.g.* a rock or wall, or the pier of a bridge; or from the bites of animals.

2. **Ligatures** are found round the hands or feet, or weights are found attached to the body. In such cases accident is contra-indicated. If the ligatures are found tied in such a way that the individual himself could not have tied them (but not unless this is the case) suicide also is contra-indicated.

3. The body is found **in shallow water.**—In this case accident is contra-indicated, unless the individual was intoxicated or insensible at the time of immersion or a child in a tub

of water. Suicide is not contra-indicated, as cases are known of individuals drowning themselves in water only a few inches deep. If drowning in shallow water is homicidal, marks of violence due to the force employed in holding the victim under water will usually be present. Here it may be mentioned that in some parts of India a form of ordeal to which women suspected of witchcraft are in some instances subjected, is holding the head under water during the time an arrow is shot from a bow and brought back to the place from which it was shot.[1]

Case.—**Weeds in mouth** indicate site of drowning.—The body of a child was found in a tank at a considerable distance from his own house, and suspicion was naturally excited that he had been conveyed thither and made away with. Dissection afforded clear evidence of death from drowning: the fauces, larynx, and trachea contained small portions of green vegetable matter, and the right bronchus was almost completely filled with so large a portion of an aquatic weed, doubled together, that it appeared astonishing how any such body could pass the *rima*. It was afterwards proved distinctly that no weed of the kind grew in the tank where the body was found. Further inquiry led to the discovery that the boy's body had been found by a woman in a tank near his home, in which the weed, lodged in the air passages, grew abundantly. This female had conveyed the corpse to the more distant tank, which belonged to a person against whom she bore a grudge.—Chevers, *Med. Jur.*

For other cases see Appendix VII.

[1] Gribble, *Med. Jur.*, p. 154.

CHAPTER VIII.

BURNS AND SCALDS.

'BURNS' are injuries produced by the application of flame or heated substances to the body, while 'scalds' result from the application of steam or hot liquid at or near its boiling-point. The effects of burns and scalds are essentially the same. Injuries caused by the application to the surface of the body of corrosive substances, *i.e.* such substances as cause chemical destruction of the tissues, may also, for medico-legal purposes, be classed as burns. The chief medico-legal questions connected with burns and scalds are:—I. Is the injury a burn or scald, and if so, how was it caused? II. Was the injury inflicted during life? III. Was the injury the result of accident, self-inflicted, or inflicted by another? and IV. What results followed, or are likely to follow, from the injury?

I.—Is the Injury a Burn, or Scald, and if so, how was it caused?

A conclusion arrived at in regard to this question may be of importance.

1. By *ss.* 324 and 326 of the Indian Penal Code, the causing of hurt, or grievous hurt, by certain specified means, is made an offence punishable more severely than when such means have not been used. Among the means specified in these two sections are not only what may be called lethal weapons (see pp. 117 *et seq.*), but also "fire or any heated substance," or any "corrosive substance," or "explosive substance."

2. It may affect the question of the guilt or innocence of an accused person. In this respect it may be of much importance to determine, if possible, the precise means whereby the injury, if a burn, was produced, *e.g.* whether produced by the application of a particular heated solid, or of a heated liquid, or by the application of a particular corrosive substance.

Degrees of burns.—For medico-legal purposes, injuries caused by the application of heated substances to the body may be divided into: (1) Burns producing mere redness. (2) Burns causing mere vesication. (3) Burns causing the death of the part injured. And to these three classes may be

added a fourth, viz. (4) burns caused by the external application of corrosive substances.

(1) **Burns producing mere redness** are usually caused by the momentary application to the part of a hot solid, or of a fluid at a temperature several degrees below the boiling-point of water. They are followed by superficial inflammation, with or without desquamation of the cuticle. Burns of this class may be simulated by the application of various mild irritants to the skin.

(2) **Burns causing vesication** are produced by the application of liquids at a temperature about that of boiling-water; or by the momentary application to the part of a flame, or of a highly heated solid. Burns of this second class, caused by flame or by highly heated solids, may be accompanied by blackening of the skin and scorching of the hair at the seat of injury. In mild burns of this second class, the vesicles simply dry up and heal, and no permanent marks are left. In severe cases, or in unhealthy subjects, suppuration of the vesicles may occur, followed by ulcers, leaving permanent cicatrices. Burns of this second class may be simulated by the application to the skin of various strong irritants, *e.g.* cantharides and tartar emetic. In badly nourished persons vesication of the skin, resembling a burn, may occur without the application of heat.[1]

(3) **Burns causing the death of the part injured** are produced by prolonged contact with flame or with highly heated solids, or by contact with liquids at a temperature considerably above that of boiling water, *e.g.* boiling oils or melted metals. They vary in appearance and degree of gravity, according to the depth to which the injury extends, *e.g.* the death of a portion of the skin only may have been caused (*Dupuytren's 3rd and 4th degrees*); or the underlying soft parts, as well as the skin, may be affected (*Dupuytren's 5th degree*); or an entire limb, bones and all, may be destroyed (*Dupuytren's 6th degree*). Burns of this class often leave sores difficult to heal, or so large in extent as to require the performance of an amputation. They leave permanent cicatrices, which frequently contract considerably, causing by their contraction considerable deformity, or impairment of the use of members or joints. If a burn of this class has been caused by the application of a heated solid, the form of the solid employed may frequently be inferred from the shape of the burn. In burns produced by highly heated solids or liquids, the skin, if moist, may be brought into contact for a short time with substances at a high temperature, *e.g.* red-hot solids or melted metals, without a burn being produced. This depends on the assumption of the spheroidal state by the moisture on the surface of the skin, and as a high temperature is necessary for the production of this spheroidal state, the temperature of the substance brought into contact with the skin must be high, otherwise a burn will be produced.

(4) **Burns caused** by the application of corrosive substances to the body seldom extend deeper than the true skin. Vesication does not accompany burns of this description, and there is no scorching of the hair in the neighbourhood of the burn. Further, if the corrosive substance is, as is commonly the case, a liquid, marks of trickling will usually be found on the clothes of the person injured. The particular corrosive employed may frequently be inferred from the colour of the marks on the skin, or definitely ascertained by chemical examination of the stained portions of clothing (see 'Corrosive Poisons,' Chap. XXII.).

[1] Guy's *For. Med.*, p. 305.

II.—Was the Injury inflicted during Life?

This question sometimes arises, *e.g.* in cases where, in order to conceal a murder, an attempt is made to burn the body of the murdered person. The chief appearances whereby burns inflicted during life may be distinguished from *post mortem* burns are presence of (1) signs of inflammation; (2) a line of redness; and (3) vesication.

(1) **Signs of inflammation** and reparative action, such as the presence of granulations or pus on the injured surface, indicate that the injury was inflicted some considerable time before death. The absence of such signs, of course, does not indicate that the injury was inflicted after death.

(2) **A line of redness.**—If a burn is inflicted during life, in the great majority of cases, a line of redness almost immediately forms round the injured surface. This line of redness, although it may be surrounded externally by a blush, disappearing on pressure or after death, does not itself disappear on pressure, and remains visible after death has taken place. The presence of a line of redness possessing the above characters is almost certain evidence that the burn was inflicted during life, and conclusive evidence that it was inflicted during life, or within ten minutes after death. Its absence, however, is not positive evidence that the burn was inflicted after death.

(3) **Vesication.**—Here it is convenient to distinguish between what may be called respectively true and false vesication. In true vesication the vesicles contain serum very rich in albumen. In false vesication the vesicles either contain air only, or (especially in dropsical bodies) a small quantity of serum, in which traces only of albumen are present. The presence of true vesication, as the result of a burn, is proof that the injury was inflicted during life. The presence of false vesication, as the result of a burn, shows that the injury was inflicted after death. The entire absence of all vesication is quite consistent with the supposition that the burn was inflicted during life, as the fire continuing after death may dry up the vesicles.

III.—Was the Injury the result of accident, self-inflicted, or inflicted by another?

Accidental cases are so common that the presumption is always in favour of accident. Accidental cases may arise from

an individual's clothes catching fire, or having heated liquid spilt accidentally over him: or a petroleum lamp breaks, and its oil catches fire and falls on him. Sometimes persons in a state of intoxication fall asleep near a fire and are accidentally burnt to death; and there are also the rare cases of so-called spontaneous combustion. In the majority of accidental cases, examination of the body throws little or no light on the question whether the injury was or was not the result of accident. It may, however, be noted that burns on several distinct and separate portions of the body contra-indicates accident, whilst the discovery of the burned body at the spot where ignition first took place is consistent with the supposition of accident, if the individual was narcotized or insensible at the time ignition occurred. Marks of violence present on the body do not necessarily contra-indicate accident. Such marks may, for example, be due to injuries received prior to, or at the time of, accidental ignition. It must be borne in mind also that sometimes marks closely resembling wounds are produced as the result of a burn.

Suicidal cases are becoming more common as *sati* in India of late (1917) is becoming more popular.

Burns are sometimes self-inflicted in order to support a false charge. Where this is suspected, the question whether or no the injuries correspond in appearance to the alleged method of production must be carefully considered (see *Case* below).

Case.—**False charge of burning.**—"In March, 1865, the assistant magistrate of Howrah sent me a girl about ten years old, for my opinion as to how certain marks on her cheeks, arms, and back were caused. She asserted that they were burned with a hot *chillum* (tobacco-pipe), whereas the accused declared that they had been made with some paint. I found a large circular brown mark on either cheek; each of these marks had a clean and perfectly defined edge. The marks on the arms and back were parallel brown streaks, with clean edges; there was no vesication, but the cuticle was beginning to separate. Such even, clear-edged, symmetrical marks could not have been inflicted with a heated body upon any person who was not in a state of complete insensibility, and from their shape it was evident that they could not have been caused by the application of a *chillum*. I gave it as my opinion that a fluid irritant had been applied, and that the case had been trumped up."—Chevers, *Med. Jur.*, p. 532.

It must be recollected that the application of the actual cautery, or of moxas, or of strong blistering agents, to the body, is a favourite method of treatment among *hakims* in India, and that false charges may be found on burns so produced. The presence also of such burns on a dead body

may give rise to an erroneous suspicion as to the cause of death.

Homicidal cases, and cases of the infliction of hurt, by burning, are not infrequent in India. Chevers mentions a number of cases, the means employed being, in many of them, the application of heated iron instruments, *e.g.* sickles or ladles or spoons, to the part. In other cases, placing the victim over a fire, applying a lighted torch or a piece of ignited charcoal or a heated pipe-bowl, or pouring heated oil on the body, or covering a portion of the body with tow or rags steeped in oil and setting fire thereto, were the means resorted to.

Case.—**Homicidal scalding.**—Several *darwans* of the Bengal Paper Mills at Raniganj attacked a European assistant, Mr. Ironside, and threw him into a hot-water tank on the 11th July, 1899. The surgeon of Burdwan examined the body on the morning of the 13th, and found bruises on the left side and left shoulder, and marks on the throat and neck, bruises on the chest and severe bruises on the left side of the head above the temple. The *post mortem* examination showed an effusion of blood into the thorax. The immediate cause of death was considered to be immersion in the hot-water tank, the temperature of which was 130°. Deceased died immediately after immersion, as a result of the extreme shock. The severe bruise on the head was caused by some blunt instrument, and may have caused insensibility, but not death. The defence set up was that Mr. Ironside accidentally fell in the tank while running away from the natives, with whom he had quarrelled.

In several of Chevers' cases the victims were females, and the burns were inflicted on the pudenda, as a punishment for suspected adultery. In others the victims were children, the burns being inflicted as a punishment for trifling offences. Chevers also mentions numerous cases of the use by dacoits of torture by fire, for the purpose of extorting information from their victims, as to the place of concealment of money or valuables; and also cases in which thieves, or persons suspected of theft, have been tortured by burning, as a punishment, or in order to extort confession. Again, plunging the arm into boiling oil is a form of ordeal to which women suspected of witchcraft are subjected in some parts of India. Along with homicidal cases may be classed cases where an attempt is made to conceal a murder by burning the body of the murdered person. In such cases nothing but fragments of partially charred bones may be discovered (see *Case* below).

Case.—**Supposed attempt to conceal murder** by burning the body.—In a case forwarded from Sakkar (Sindh) some fragments of partly burnt bones were sent for opinion as to whether the same were or were not fragments of human bones. Several of the fragments forwarded were clearly identified as fragments of the bones of an adult human being. A

summary of the history of this case is as follows :—Two men started out together, one carrying an axe ; after a time one of the two returned, the other seemingly having disappeared. Trackers were placed on the trail made by the two men, and they, on following the trail, came to a place where the double trail ended, and a return single trail began ; at this place the fragments or bone sent for examination were found.—Bombay *Chemical Analyser's Report* for 1883, p. 9.

In other cases the soft part may be more or less entire, and then two questions obviously arise, viz. (*a*) Have the burns the character of *post mortem* or *ante-mortem* burns ? and (*b*) Does examination of the body reveal a cause for death (or for the occurrence of insensibility) irrespective of the burns ? The first of these questions has already been discussed (see *Quest. II.*). In regard to the second question, the only special point to be noted is, that, as already mentioned, injuries resembling to a certain extent wounds caused by mechanical violence may be produced on a body by the action of heat alone.

IV.—What Results followed, or are likely to follow, from the Injury ?

For medico-legal purposes in India this question, as in the case of wounds (see p. 168), becomes : Has the injury caused, or is it likely to cause, death ; and if not, has it caused one or other of those forms of hurt which are by the law of India designated as ' grievous hurt ' ? In this regard note :—

1. **Death** may occur from burns (1) Before reaction sets in, *i.e.* within forty-eight hours of the receipt of the injury, from (*a*) shock or collapse ; or (*b*) coma, due to congestion of the brain, and serous effusion into the ventricles (this may be mistaken for opium poison). (2) After reaction has set in, from (*c*) various internal inflammations, *e.g.* pneumonia, bronchitis, pleurisy, enteritis. Enteritis with ulceration, followed by peritonitis, is a not infrequent cause of death from burning, especially in young people ; (*d*) surgical complications connected with the injury, *e.g.* gangrene, erysipelas, tetanus, pyæmia, etc. ; or (*e*) from exhaustion.

2. **The danger to life** in burns depends chiefly on (1) extent of surface injured.—Burns involving a great extent of surface are specially dangerous to life. "A burn involving two-thirds, or even one-half of the entire skin, may be regarded as certain to destroy life, and the same practically may be said

of a burn (if severe) involving one-third of the body" (Tidy): deep burns involving a limited portion of the body are not nearly so dangerous to life as burns involving a wide extent of surface. (2) part burnt.—Burns on the trunk are more dangerous to life than burns on the extremities, and death before reaction has set in is specially likely to occur in the case of burns involving a wide extent of surface on the trunk. (3) the depth of the burn, and (4) age of the patient.—Children, as a rule, bear burns badly, whilst old people bear them comparatively well (Tidy). **The most fatal period** after a burn is the first week. Erichsen found that in 54 per cent. of fatal cases death occurred within four days, and in 66 per cent. within eight days, after receipt of the injury.

3. **The post mortem** signs of death from burns.—The soft parts may be entirely destroyed, and it may be impossible from the *post mortem* appearances to form any opinion as to whether death was due to burning, or to some other cause operating before cremation of the body. If the soft parts are more or less entire, the *post mortem* appearances present may be: External, viz. marks on the surface of the body, having the characters possessed by burns inflicted during life, and varying in appearance according to the length of time which has elapsed between receipt of the injury and death. If the body is roasted the limbs are usually contracted or flexed; be careful, therefore, in attempting to straighten the limbs, as the roasted skin may crack, and similar 'wounds' may have taken place before your arrival. **Internal.**—Perforating ulcers of the duodenum, resulting from inflammation of Brunner's glands, are common in cases of deaths from burns especially in young children (Curling). Peyer's patches, and the solitary glands generally, are often greatly inflamed and sometimes ulcerated (Tidy); (*c*) Congestion of various organs, *e.g.* the brain, lungs, liver, kidneys, etc.

In making a post mortem examination in a case of alleged death from burns, it must always be borne in mind that death (or insensibility) may have been produced by causes operating previously to the infliction of the burns. Hence, in cases of alleged death from burning, it is extremely important to note: (*a*) Whether or not the burns possess the characters of burns inflicted during life; and (*b*) whether the examination of the body reveals any cause for the occurrence of death (or insensibility) other than burning; and if wounds are present on the body, to note whether they appear to have been caused by the action of fire or not.

Case.—**Apparent wounds** caused by burning.—A boy, *æt.* two, was brought to hospital severely burnt and died in three-quarters of an hour. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella, or knee-pan, where it became somewhat jagged, and making a sudden turn inwards, passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh, a little above the knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the fatty tissue, had not yielded with it. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of fire, and the irregular character and appearance of the fissures, Mr. Curling considered them to have been occasioned by the influence of heat.—Taylor, *Med. Jur.*, p. 715.

4. **'Grievous hurt' may be caused by burns.**—The injuries which, by *s.* 320 of the Indian Penal Code, are designated as 'grievous hurt,' have already been enumerated. Burns are especially likely to cause the following forms of 'grievous hurt':—(*a*) Hurt "*which endangers life, or which causes the sufferer to be, during the space of twenty days, in severe bodily pain or unable to follow his ordinary pursuits.*" It has before been noted that burns involving a wide extent of surface (especially of the trunk) are specially dangerous to life. (*b*) If the burns are on the head or face, especially if the true skin is affected to any depth, "*permanent disfiguration of the head or face*" is likely to result. (*c*) "*Permanent privation of the sight of either eye*" is a not unfrequent result of the throwing of corrosive fluids, *e.g.* oil of vitriol, over the body. (*d*) "*Permanent impairment of the powers of*" a "*member or joint*" is specially likely to occur (from contraction of cicatrices) in the case of severe burns in the neighbourhood of joints.

Spontaneous Combustion.

The question whether the human body is liable to spontaneous combustion has arisen in the following way:—It is well known that in ordinary circumstances long exposure to a high temperature, and the expenditure of a considerable amount of fuel is required in order to cause any considerable amount of charring of a human body. Several cases, however, are on record where the bodies of persons, generally old obese females addicted to spirits, have been found near a fire or partly burned candle, half-consumed, and exhaling a fœtid, empyreumatic odour. In many of these cases, articles near the body have been found

covered with a greasy, stinking soot, but although combustible, unburnt, indicating that the temperature of combustion has been comparatively low (see *Case*, p. 251).

In order to start the combustion of an inflammable substance, a portion of it—no matter how small—must be raised to a particular temperature. The temperature required varies with the substance. A mass of phosphorus will take fire if any portion of it be raised to the comparatively low temperature of 140° F. Hydrogen, on the other hand, requires a high temperature for its ignition. When a portion of the inflammable substance, or mixture of inflammable substances, is capable of acquiring the temperature necessary for ignition either *per se*, or on contact with air only; such substance, or mixture of substances, is liable to catch fire spontaneously. In such substances, the self-acquirement of the temperature necessary for ignition is the result of the development of heat by chemical action, such chemical action taking place either between the substance and the oxygen of the air, or, in a few cases, between two of the constituents of a mixture. The principal substances liable to spontaneous combustion are :—

1. **Certain simple bodies.**—Phosphorus is the best known example of this class. This substance, in its ordinary condition, oxidizes in air even at a temperature of 50° F., and requires only a comparatively low temperature for ignition; hence, it is peculiarly liable to catch fire spontaneously. Certain of the metals, if in a finely divided condition, *e.g.* iron, are liable to take fire on exposure to air, owing to heat developed by the combination of the metal with oxygen.

2. **Certain compound bodies** take fire at once on exposure to air, *e.g.* silicon hydride, liquid phosphide of hydrogen, and zinc ethyl. The presence of a small quantity of the vapour of liquid phosphide of hydrogen also, it may be remarked, confers the property of spontaneous inflammability on combustible gases.

3. **Certain mixtures of substances** are liable to spontaneous combustion from :—(*a*) The occurrence of chemical action between the constituents of the mixture, *e.g.* phosphorus takes fire on being brought into contact with iodine. Many finely divided metals and paper moistened with turpentine take fire in chlorine. Turpentine takes fire if mixed with fuming nitric acid, etc. Probably the occasional spontaneous combustion of red fire (a mixture of sulphur, carbon, antimony sulphide, potassic chlorate, and strontium nitrate) is due to this cause. (*b*) The oxidation of one of the constituents of the mixture.—The constituent undergoing oxidation may be an inorganic substance, *e.g.* a metallic sulphide. Some varieties of coal contain iron pyrites (sulphide of iron) in considerable quantity, and are liable to spontaneous combustion from heat developed by the combination of this with the oxygen of the air. Again, the constituent undergoing oxidation may be an organic substance, *e.g.* a drying oil. Numerous cases are on record of the spontaneous ignition of fibrous and other combustible substances moistened with a drying oil, *i.e.* an oil capable of drying readily into a resin by taking up oxygen from the air. Cotton, wool, hemp, flax, jute, woody fibre, and lamp-black have all been known to catch fire spontaneously when moistened with linseed or other drying oils. Woody fibre moistened with turpentine has been known to catch fire from a similar action.

Organic matters moistened with water only, *e.g.* damp hay, cotton, tow, flax, cocoanut fibre, leaves, etc., are liable to become heated from oxidation. Spontaneous ignition of damp hay and cotton, and of damp oats and esparto grass, has been known to occur. It may also be

remarked that certain explosive substances are liable to explode either spontaneously, *e.g.* chloride of nitrogen, or from a very slight amount of percussion or friction, *e.g.* nitro-glycerine, the metallic fulminates, and mixtures of combustible substances with potassic chlorate.

Case.—**So-called 'spontaneous' combustion** of the human body.—In the *Phil. Trans.*, Vol. XLIII. p. 463, it is recorded that "Grace Pett, the wife of a fishmonger at St. Clements, Ipswich, used to go downstairs every night, half dressed, to smoke a pipe. On the 9th of April, 1744, she got up from bed as usual. Her daughter, who slept with her, did not perceive that her mother was absent till next morning when she awoke. Soon after this she put on her clothes, and, going down into the kitchen, found her mother stretched out on her right side, with her head near the grate. The body was extended near the hearth, with the legs on the deal floor, and it had the appearance of a log of wood consumed by a fire without apparent flame. On beholding the spectacle, the girl ran in great haste and poured some water over her mother's body, to extinguish the fire. The fœtid odour and smoke which exhaled from the body almost suffocated some of the neighbours, who had hastened to the girl's assistance. The trunk was in some measure incinerated, and resembled a heap of coals covered with white ashes. The head, the arms, the legs, and the thighs had also participated in the burning. This woman, it is said, *had drunk a large quantity of spirituous liquor*, in consequence of being overjoyed to hear that one of her daughters had returned from Gibraltar. There was no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick, which was close to her. There were also found near the consumed body the clothes of a child and a paper screen, which had sustained no injury. Her dress consisted of a cotton gown."—Woodman and Tidy, *For. Med.*, p. 1010.

Case.—**Spontaneous combustion** put forward as a defence to a charge of murder. "In March, 1850, a man named *Stauff* was tried at Darmstadt for the murder of the *Countess of Gœrilitz*. He had assaulted the deceased in her chamber, and then set fire to the furniture, with a view to conceal his crime. The body and dress were partially consumed. As the means by which the fire was applied were not at once apparent, and the assassin had locked the doors of the room, some medical men took up the theory that the deceased had died from spontaneous combustion. The facts of the case were referred to Professors Liebig and Bischoff, of Giessen, and their report was issued in March, 1850, at which date the man Stauff was put on his trial. They found no difficulty in concluding that a murder had been perpetrated, and the body wilfully *burnt after death*, for the purpose of concealing the crime." Stauff was convicted, and subsequently confessed that he had strangled the countess, and then, heaping articles of furniture around the body, had set fire to them, with the object of concealing the murder.—Taylor, *Manual*, p. 348.

Death from HEAT.

SUNSTROKE, INSOLATION, 'COUP DE SOLEIL,' HEAT-APOPLEXY.

Death from heat seldom becomes the subject of medico-legal inquiry except in cases of sudden death in heated engine-rooms or factories or cases found dead in railway carriages, where there is suspicion of foul play.

Death from heat may occur in two ways :—

(1) **Heat Exhaustion,** sudden syncope or faintness from exposure to high and usually moist temperature of the air. Patient suddenly feels faint, turns pale, pulse is weak, soft and fluttering, respiration shallow, skin cold, temperature sub-normal.

(2) **Heat-Stroke or Sun-Stroke,** usually by exposure to intense sun-heat. The symptoms may set in suddenly, or there may be premonitory symptoms, such as headache and vomiting. These are followed usually by confusion of vision, flushing of the face, conjunctivæ congested, and stupor or coma. The temperature is invariably high. The pupils are generally dilated in the earlier, and contracted to a fine point in the later, stages. In a few cases delirium and convulsions are present. Death has been known to occur in five minutes, or as late as three days, after the commencement of the attack.

Circumstances modifying the effect on the system of exposure to heat are :—

1. **Moisture** present in the atmosphere.—Other things being equal, the less this is, the better exposure to heat is borne. The presence of a large amount of moisture in the atmosphere interferes with evaporation from the surface of the body, and favours the action of heat on the system.

2. **Duration of exposure.**—Very high temperatures can be borne for a short time, but not for long, without ill-effects. Chabert, 'the Fire King,' was in the habit of entering an oven the temperature of which was from 400° to 600° F.

3. **Habit.**—This appears, to a certain extent, to lessen the effect of exposure to heat. Individuals accustomed to carry on their daily work in an atmosphere of high temperature, apparently withstand the action of heat better than others.

4. **Bodily condition of individual.**—The action of heat on the system is favoured by exhaustion, indulgence in alcoholic liquors, or anything which checks elimination, or embarrasses the normal working of the organic system. In 90 per cent. of cases of Heat-Stroke personally examined in Eastern Bengal and Bombay, Powell has found evidence of (1) malaria, (2) alcoholic excess, or (3) syphilis, sometimes all three in the some case.

Post mortem appearances.—In some cases no abnormal appearance has been present. In the majority of cases, congestion of the brain and its membranes, engorgement of the right side of the heart and congestion of the lungs and abdominal viscera are found. The blood is frequently fluid and dark in colour, hence there is great *post-mortem* lividity and decomposition sets in rapidly.

Death from COLD.

If, from exposure to cold, the temperature of the human body becomes reduced for any length of time much below the normal, death occurs. In exceptional cases the temperature of the body has been known to fall as low as 79°, or even 75° F., without life being extinguished.

Constitutional symptoms produced by exposure to cold are depression of the heart's action, and torpor, succeeded by stupor or coma, from congestion of the nervous centres. In addition, exposure to cold may produce certain local effects, *e.g.* chilblains or, in severe cases, frost-bite, the part affected becoming, when frost-bitten, bloodless, ash-grey, and insensible. If a part affected with frost-bite is warmed too suddenly, gangrene is apt to set in, hence, warmth should be restored to frost-bitten parts gradually, as, for example, by friction with snow.

Circumstances modifying the action on the system of exposure to cold are :—

1. **Wind.**—Air being a bad conductor of heat, cold still air produces much less harmful effect on the body than cold air in motion, as in a wind.

2. **Moisture.**—If the surface of the body be wet, or covered with wet clothing, and exposed to cold air, heat, owing to evaporation, is withdrawn more rapidly than if the surface of the body be dry.

3. **Duration of exposure.**—Of course the longer the exposure to cold, the more likely are ill effects to occur. Adopting proper precautions, however, an extremely low atmospheric temperature may, as in the case of arctic voyagers, be borne for long periods.

4. **Age.**—Adults bear cold better than the very young and very old.

5. **Bodily condition.**—The action of cold on the system is favoured by anything which tends to lower the vital powers, *e.g.* fatigue, exhaustion, intoxication, want of food, etc.

Post mortem appearances are not very characteristic; they are, according to Ogston :—(*a*) Arterial hue of blood generally, except when viewed in mass within the heart. (*b*) Unusual accumulation of blood on both sides of the heart, and in the large thoracic arteries and veins. (*c*) Irregular diffused dusky-red patches on limited portions of the surface of the body, even in the non-dependent parts. (*d*) Pallor of the surface of the body, accompanied, according to Ogston, with anæmia, but, according to other authorities, with congestion of the viscera most largely supplied with blood. Ogston, however, found moderate congestion of the brain in three, and of the liver in seven, out of sixteen cases.

Death from cold is, as a rule, accidental, as in drunkards falling asleep in the snow or people lost in snowdrifts. Exposure to cold is a common method of infanticide in temperate climates, death taking place rapidly. Cases where insane persons have, it is alleged, been killed by exposure to cold, sometimes form the subject of a medico-legal inquiry. Taylor

mentions a case where the death of a lunatic appears to have occurred from the combined effect of a shower-bath at 45° F. for half an hour, followed by a full dose of tartar emetic.

Death from LIGHTNING and ELECTRICITY.

Death by lightning with marks of violence on the body which have been attributed to murder sometimes require medico-legal investigation.

The human body is a feeble conductor of electricity; it allows of the passage through it, by conduction, of charges of electricity up to a certain pitch of intensity; but if this be exceeded, discharge taking place through the body becomes of the nature of a disruptive discharge. The passage of a feeble charge of electricity by conduction through the body usually produces no ill-effects. A strong charge—strong enough to kill by shock—may pass through the body by conduction, or at any rate without producing visible separation of its particles; hence, in some cases of death from discharge of electricity, no wounds can be discovered. Very strong charges of electricity discharging through the body usually produce visible wounds. **Heat** may be evidenced by the skin or clothes showing marks of burning; metal articles attached to the clothes, such as buttons, or carried in the pockets, show signs of fusion; and steel articles, a knife for example, are found to have acquired magnetism.

Conditions of lightning stroke.—Lightning stroke has occurred in almost every situation. Thus persons have been struck by lightning in the open, in houses (in one case a boy in bed was struck by lightning), under trees, etc., etc. Not infrequently, of two or three persons standing near one another, one is struck, the others escaping. During a thunderstorm the neighbourhood of a high projecting bad or feeble conductor, such as a solitary tree, is a specially dangerous situation. The projecting object attracts the accumulated electricity, but, being a bad or feeble conductor, opposes such resistance to its passage that lateral discharge takes place into neighbouring objects, *e.g.* into the body of an individual standing near. The neighbourhood of a good conductor, if of insufficient thickness, is dangerous, for a precisely similar reason. Telegraph clerks, for example, have, during thunderstorms, been killed while standing at their instruments, owing to the wires in connection therewith, from their insufficient thickness, opposing so much resistance as to cause lateral discharge. The attraction of projecting objects for electricity necessitates the protection of high buildings by lightning conductors. These are thick rods of copper, one end of which projects above the building, while the other is buried in wet earth. All metal-work on the surface of the building should be in electrical connection with the lightning conductor by thick wires. A peculiar class of cases of death resulting from the discharge of atmospheric electricity are the cases in which individuals are killed by what is called the 'return shock.' In these cases the person killed is sometimes at a considerable distance from the spot where the discharge of lightning takes place. Cases of this kind are explained as follows: A cloud charged with electricity induces a charge of the opposite kind in objects—*e.g.* the bodies of individuals—in its neighbourhood. When the cloud discharges itself, the inducing influence being suddenly withdrawn, these objects suddenly discharge

their induced charge of electricity. Sometimes this discharge of induced electricity from the body of an individual is so violent as to produce a severe or even fatal shock. In cases of this kind no marks of injury are found on the body of the sufferer.

Death or injury from electricity other than atmospheric electricity.—This is usually by accident. Powerful 'arc' electric lamps (*i.e.* lamps in which the light is produced by disruptive discharge between carbon terminals), require currents of great intensity. Two or three cases have lately been recorded where individuals have been killed by accidentally 'short-circuiting' such currents through their bodies, *e.g.* by grasping the wires conveying the current one in either hand, or by standing on one wire and laying hold of the other, or passers-by near leaks at broken wires on the electric tramway lines in Calcutta and other cities. 'Electrocuting' is the judicial form of execution in the United States of America and some other countries in place of the time-honoured method of hanging.

The effects produced on the body by the passage through it of an electrical discharge may be—(1) Local; (2) Constitutional.

Local effects produced may be burns, blisters, or wounds; or ecchymosed streaks, spots, or patches. Burns and blisters are sometimes the result of the clothes having caught fire, but may occur independently of any ignition of the clothes. The hair is often found singed. If a wound is found it may be lacerated, punctured, or contused in character. Ecchymosed or livid patches, spots or streaks are frequently met with. Sometimes the streaks present a peculiar arborescent appearance. Fractures are rare, but have been found in a few cases (Tidy). No marks whatever may be found on the body, even in fatal cases, in which the clothes have been burned.

(2) **Constitutional** effects produced may be immediate death from shock; or the individual may fall down insensible and die after an interval, varying from a few minutes to several days. In one case death occurred as late as the thirty-third day after the receipt of the injury. If immediate death is not caused, the probabilities appear to be in favour of recovery taking place. In non-fatal cases various nervous affections have been found, *e.g.* paralysis (hemiplegia or paraplegia), loss of sight, hearing, speech, or memory; or there may be no apparent effect beyond the momentary shock if the current is slight.

Signs of death or injury from electricity may be:—

1. **External marks on body.**—The nature of these has been already described. The livid arborescent streaks found on the body in some cases are peculiarly characteristic of death from lightning stroke. The marks present on the body may similate in appearance marks of mechanical violence.

2. **Internal appearances.**—Injury to the brain or its membranes is frequently found. The membranes may be congested or lacerated. The brain may be congested or disorganized. Blood may be found effused on the surface or into the interior of the brain.

3. **Objects on or near the body** may show signs of the passage of electric discharge. The clothes may be found burnt or torn; the boots have sometimes been found burst open. In one case the whole of a man's

clothes were torn off his body and scattered about. Metal articles attached to the clothes or carried in the pockets may be found fused; and steel articles may be found to have become magnetic. Objects in the neighbourhood of the body may be found to show signs of injury, *e.g.* a wall or building may be found cracked, or shattered and thrown down. Trees may be found split, and combustible objects, especially if dry, may be set on fire, or show marks of burning.

Rigor mortis sets in rapidly and putrefaction may be hastened.

CHAPTER IX.

DEATH FROM STARVATION.

ACUTE and chronic starvation through deprivation of food have similar symptoms. In acute starvation death takes place usually in ten to twelve days, accompanied by mania and convulsions.

The essential nutritive constituents of food are: (1) Albuminates, (2) Carbohydrates, (3) Fats, and (4) Salts. In order to maintain health and strength, a certain amount of each of these, plus a certain amount of water, must be daily supplied. Of the essential nutritive constituents of food the albuminates, *e.g.* albumen and casein, contain both carbon and nitrogen. The carbohydrates, *e.g.* starch and sugar, contain carbon but no nitrogen. The fats, like the carbohydrates, contain no nitrogen, they, however, contain a larger percentage of carbon than the carbohydrates. For convenience, we may call the nitrogen contained in albuminates nutritive nitrogen, and the carbon contained in albuminates carbohydrates, and fats nutritive carbon.

The daily food requirements depend (*a*) on the weight (in health) of the individual to be fed; (*b*) on the amount of work performed; and (*c*) on the age of the individual (children require more food in proportion to their weight than adults, seeing that in their case growth as well as nutrition must be provided for). An adult requires daily if at rest 25 grains, or if at work about 30 to 45 or 50 grains (according to the amount of work done) of nutritive carbon per 1 lb. of body weight. With this amount of carbon, nutritive nitrogen must be supplied in amount equal to one-fifteenth to one-twentieth of the weight of the carbon. The food must contain fat in a certain amount, say about 1 to 3 ounces per diem. The food must contain salts in a certain amount, *e.g.* phosphates, required for the nutrition of the body; also a certain amount of common salt, say $\frac{1}{4}$ to $\frac{1}{2}$ an ounce; water, 3 to 6 pints daily, and condiments. The food should be varied in character, of good quality, properly cooked, and the intervals between meals should not be too long.

A rough rule for calculating the daily food requirements of adult natives of India is as follows:—Given (*a*) that the food consists solely of cereals and pulses fairly free from husk, and that the dietary contains a sufficiency of fat, and (*b*) that the amount of nutritive nitrogen in the dietary equals about one-twentieth of the carbon, then the number of ounces of food daily supplied must be not less than the average body weight in pounds of the individuals to be fed, multiplied by:—For bare subsistence, 0·16. For light work, say not over 1 foot-ton per 1 lb. of body weight, 0·21. For moderate work, say not over 2 foot-tons per 1 lb. of body weight, 0·26. For hard work, say up to 3 foot-tons per 1 lb. of body weight, 0·31.

Rapidity with which ill-effects follow deficient supply of nourishment is affected by—

1. **Age.**—Old persons bear deprivation of food better than adults, and adults bear it better than children.

2. **Condition of body.**—Fat people bear deprivation of food best. Diminished activity of the vital functions (as in catalepsy) delays the occurrence of ill effects from deprivation of food.

3. **Exposure to cold.**—Where the loss of heat from the surface of the body is rapid, the effects resulting from a deficient supply of the matters (food) required to maintain the normal temperature are more quickly felt than when the loss of heat from the surface is slow.

4. **Deprivation of water.**—Complete abstinence from both food and water kills more rapidly than abstinence from food alone. Taylor[1] states that it is probable, that in a healthy person under perfect abstinence (from both water and food), death would not commonly take place in a shorter period than a week or ten days. Guy[2] mentions a case of shipwreck where, of eighteen persons deprived of food and water, only one survived the eighteenth day. Where the abstinence is from food only, an individual may survive for a much longer period. Thus a case is recorded of a madman who survived forty-seven days, and another of survival for sixty-one days; in the first of these two cases water only was taken, in the second water and a little orange-juice.

Symptoms of starvation.—The chief:—

1. **Emaciation, loss of weight.**—The subcutaneous fat disappears and the muscles waste; so that the skin of the face becomes wrinkled, and that of the body, especially in previously plump persons, becomes baggy. Chossat, from a series of experiments on animals, found, as a rule, death to occur when the animal had lost two-fifths of its weight. Observation seems to indicate that this rule holds fairly good in the case of human beings.

2. **Exhaustion and weakening of voice.**

3. **Pallor and cadaverous look.**

4. **Thirst,** pain and irritation of the stomach, and usually a costive condition of the bowels. The outlets of the body are frequently found inflamed.

5. **Pulse** is at first quickened, but subsequently becomes slow. It usually, however, becomes greatly quickened on the approach of danger. —Tidy.

6. **In chronic cases especially, the skin** frequently becomes covered with "a brown filthy-looking coating," and the body emits a fœtid odour. "The gums become swollen and ulcerated, and there is great tendency to ulceration and sloughing on the receipt of slight injuries."—Cornish.

7. **Wild-looking** eyes, delirium and convulsions in some cases precede death, in other cases the mind remains unaffected.

Post mortem appearances.—These are chiefly great emaciation, a shrunken and contracted condition of the stomach and intestines with pale pearly and translucent coats, a more or less atrophied condition of

[1] *Med. Jur.*, II. 139. [2] *For. Med.*, p. 312.

the viscera, and absence—not necessarily complete in acute cases (see *Case* below)—of fat. It should be noted, however, that all these appearances may be present in death from exhausting diseases. Hence in cases of death from alleged homicidal starvation, the body should be carefully examined for appearances indicating the existence of such diseases. It may, in such cases, be an extremely difficult matter to form a definite opinion as to whether death was due to disease or starvation (for a case in which this question arose, see below).

Case.—**Prolonged sleep with starvation.**—A man of healthy habits, 43 years of age, was at intervals subject to attacks of long and persistent sleep. He would retire to bed at his usual hour, and without any warning symptoms, suddenly and almost immediately fall into a profound sleep, from which all the usual means would fail to arouse him. In this state his face and ears were pale; the skin was pale, and generally warm, but his feet were cold and livid, and the limbs quite relaxed. His pulse was soft, slow, and feeble; his respirations almost imperceptible, about eight or nine in a minute. He appeared like a person in a refreshing, tranquil slumber. There was no stertor or snoring. The longest period he ever passed in profound sleep was five days and five nights. He frequently slept three days, and occasionally four days, without waking, but his average period was two days. His secretions were suppressed, and no food was required. He commonly awoke suddenly, had no consciousness of the lapse of time, and retained a good remembrance of the last occurrences before he fell into this state. He had no dreams.—Taylor, *Med. Jur.*, I. 43.

Case.—**Homicidal starvation.**—Death from disease set up as a defence. —Deceased, Harriet Staunton, had been kept in close confinement by the accused. She was seen, a few hours before her death, by a medical man, and was then insensible and collapsed. She died in a state of complete exhaustion. On *post mortem* examination appearances indicative of death from starvation were found, the body-weight being only 74 lbs. instead of about 120 lbs., as it would have been in a healthy adult of the same age. The following *post mortem* appearances of disease were present:—(1) A slight tubercular deposit at the apex of the left lung. (2) A congested appearance of the cardiac extremity of the stomach, as well as of the duodenum. (3) Two small patches of miliary tubercular deposit (recent) upon the arachnoid on the upper surface of the left cerebral hemisphere. There were no traces of meningitis, or of disease of the brain. In this case the defence was set up that death was the result of disease. The medical men who examined the body were of opinion that death was due to starvation. Three of the four accused were convicted. —*Reg.* v. *Staunton*, Taylor's *Manual*, p. 469.

Starvation may be accidental, homicidal, or suicidal.—The most common causes of accidental starvation are:—(1) Shipwreck; (2) Mining accidents—individuals by a fall of earth getting shut up in a mine; (3) Disease, *e.g.* stricture of the œsophagus; and (4) Famine.

In Homicidal cases the victim is usually an infant or child. The withholding of food, with or without exposure to cold, is a not infrequent method of infanticide (see 'Infanticide'). Cases also are not infrequent where children have

been starved by their parents or other persons having charge of them,—'baby-farmers.' In fatal cases of this kind, as already pointed out, the body should be carefully examined for signs of disease, especially chronic wasting disease. In non-fatal cases, an unusually low body-weight, coupled with a rapid gain in weight when proper nourishment is administered, is very strong evidence in favour of starvation (see *Case* below). As already pointed out under Suffocation, in one form of *samadh*, or burial alive of lepers, the head is left uncovered, and death takes place from exhaustion, the result of starvation and exposure; and not —as in cases where the burial is complete—from suffocation. Suicidal cases are rare, but are sometimes met with, especially in the insane and prisoners who sometimes attempt to commit suicide by starving themselves.

Case.—**Starvation;** rapid gain of weight under proper feeding.—Prisoner charged with starving his servant, *æt.* 13½ years. The girl weighed thirty-five pounds. She suffered, in the cold weather, from chilblains and sloughing of the toes. When removed and properly fed she recovered her health, and gained weight at the rate of five ounces per diem for 129 days.—Tidy, *Leg. Med.*, I. p. 603; *Lancet*, August 14, 1880.

Case.—**Manslaughter by starvation in charlatan's "cure."**—At Worthing, in 1920, L. M. H., a single woman, aged 46, died under a "cure" by a "cure specialist," W. Aird and a nurse, in which the "cure" consisted of an exclusive diet of raw fruit and raw vegetables. Her body was in a state of complete emaciation, and the *post mortem* showed that death was due to acute pneumonia supervening on chronic tuberculosis. The jury found that death was due to the starvation diet, and returned a verdict of manslaughter against the "cure specialist" and nurse.—*Daily Express* (Lond.), May 27, 1920.

Pretended fasting.—Cases are on record where individuals, as a rule hysterical girls or young women, have pretended to an ability to abstain for long periods from food. A medical man should in such cases be cautious about undertaking the duty of watching the impostor with a view to detection, as if death results he may be held criminally responsible. In the case of the Welsh fasting-girl, the medical men who had accepted the responsibility of superintending the watching were indicted before the magistrates along with the parents of the girl; the parents only, however, were committed for trial.

SEXUAL CRIMES AND OFFENCES AND RELATIONSHIPS.

Sexual crimes and offences and relationships may conveniently be classed under the heads of: (1) *Impotence and Sterility;* (2) *Virginity and Defloration;* (3) *Pregnancy and Legitimacy;* (4) *Birth and Delivery* re *Inheritance;* (5) *Rape;* (6) *Abortion and Fœticide;* (7) *Criminal Infanticide; and* (8) *Unnatural Sexual Crimes. The means of identifying sex in doubtful cases has already been considered* (pp. 35, etc.).

CHAPTER X.

IMPOTENCE AND STERILITY.

SEXUAL capacity is a question that may arise with reference to marriage, charges of rape, etc.

Marriage, according to the law of England, is a contract which may be declared null and void by the court on proof that either of the parties thereto is incapable of fulfilling its terms, *i.e.* of consummating the marriage. Hence a suit for the declaration of nullity of marriage may be brought by one of the parties to the contract on the ground that the other is impotent or incapable of sexual intercourse. To obtain a decree declaring the marriage null and void on this ground it must, however, be proved: (*a*) that the incapacity existed at the time of the marriage; and (*b*) that it is of such a nature as to be incurable, or only curable by an operation to which the individual refuses to submit (see *Case*, p. 264). A marriage may also be declared null and void on the ground of insanity of one of the parties thereto at the time of the marriage (see 'Insanity'); and a "breach of promise of marriage" is justified in law by the discovery that the woman is suffering from tuberculosis (see *Case* below).

Case.—**Disease and breach of promise.**—"If a man knows that a woman is suffering from tuberculosis he is justified in breaking off his

engagement to marry her." This ruling was made by Mr. Justice Lush in the King's Bench Division in an action for breach of promise by Miss M. P. against Mr. G. B., the son of a doctor at Newport, Monmouth. —*Daily Express* (Lond.), April 6, 1919.

'**Impotence**' is the incapacity for performing the sexual act and '**sterility**' may exist in either sex, but the existence of one of these conditions does not necessarily imply the existence of the other, *e.g.* an individual may be sterile, but not impotent; or impotent, but not sterile. Sterility by itself offers no legal ground for a divorce while impotence may do so. In practice the two disabilities resolve into impotence in the male and sterility in the female. The question of the impotence of an individual may arise in (1) nullity of marriage suits; (2) rape cases, where impotence may be pleaded as a defence by the accused (see 'Rape,' Chap. XIV.), and similarly, in other cases, impotence may be set up as an answer to a charge of adultery; (3) cases of disputed right to inherit (see this subject), where an individual is alleged to be an illegitimate, or a supposititious child—here both Sterility and Impotence come in; also in (4) cases where, under certain circumstances, a woman seeks to have absolute control given to her over money, on the ground that she has no children, and is past the age of child-bearing.

Recorded instances of capability of reproduction in very advanced life are: Cato the censor, who is said to have had a son at eighty years of age; Zadisiäs, king of Poland, at the age of ninety married his second wife and had two sons. As a fact spermatozoa can often be detected in the testicles of very old men; Duplay discovered them in nine octogenarians.

In the male.

A male may be impotent or sterile or both, owing to (1) extreme youth; (2) advanced age; (3) malformation or defect; (4) disease; (5) mental causes; (6) drugs.

(1) **Extreme youth.**—According to the law of England, the earliest age at which a male can contract a valid marriage is fourteen; and a male under the age of fourteen is held incapable of committing a rape. It appears, therefore, to be a presumption of English law that a boy does not attain puberty and become potent for coitus until he has reached the age of fourteen. The law of India contains no similar presumption; a boy under the age of seven is (*I. P. Code, s.* 82) held to be incapable of committing rape or any other offence. Over that

age, the question of his capacity to commit rape is a question left to the courts to decide according to the evidence produced in the case. The age at which males attain puberty, and become soon capable of performing sexual intercourse, varies. The general age among Europeans is probably about fourteen, and among natives of India somewhat earlier. In exceptional cases puberty is attained at a very early age. Tidy mentions a case of a boy who was given to masturbation from the age of three, and of another boy aged four and a half, who attempted intercourse with his sister aged two.[1] In other cases puberty is not attained until a comparatively late age. Taylor mentions a case of a man whose penis and testicles at the age of twenty-six "but little exceeded in size those of a youth of eight years of age." This individual married, became the father of a family, and at the age of twenty-eight the organs became fully developed.[2]

Attainment of puberty and potency does not, however, necessarily imply coincident attainment of fertility. Until spermatozoa appear in the seminal fluid, an individual is sterile. Casper considers that the power of procreation commences later (and ceases earlier) than the capacity for coitus. Taylor gives fourteen as the earliest age at which the procreative power has been recorded to appear in the male.[3] Aspermatism can be detected by the microscope.

(2) **Advanced age** may of course be a cause of impotence or sterility in the male. Cases, however, are recorded of the procreation of children by men of seventy-one, eighty-one, and ninety-two; and spermatozoa have in several cases been found in the seminal fluid (indicating fertility) of men over ninety.[4] Casper once found them in a man aged ninety-six.[5] In English law there is no age from fourteen upwards at which a man is denied the power of procreating children.

(3) **Malformation or defect.**—Impregnation may result from the mere deposition of semen within the vulva.[6] No malformation or defect of the penis, therefore, can be regarded as an undoubted cause of impotence, unless it is of such a nature as to completely prevent such deposition. This being so, impotence results from complete loss or absence of the penis, or from its orifice being situated, as in complete hypospadias or epispadias, in such a position that deposition of

[1] Tidy, *Leg. Med.*, II. p. 77.
[2] Taylor, *Med. Jur.*, II. p. 290.
[3] *Ibid.*, p. 285.
[4] *Ibid.*, p. 291.
[5] Casper, II. pp. 258, 291.
[6] Tidy, *Leg. Med.*, II. p. 14.

semen within the vulva during coitus is impossible. Impotence has thus resulted from perinæal fistula. For the reason above mentioned, impotence is not necessarily the result of partial absence or loss of the penis, or of partial hypospadias or epispadias. Adhesion of the penis to the scrotum or abdomen may cause impotence remediable by a slight operation. Individuals impotent from malformation or defect of the penis are not necessarily sterile, it being possible to effect impregnation by artificial injection of the seminal fluid.

Loss of both testicles, or absence of both testicles, of course involves impotence and sterility. The power of procreation may, however, remain for a limited period after the removal of both testicles, owing to presence of accumulated seminal fluid in the vesiculæ seminales. Loss of one testicle only does not result in impotence, nor are those who have one testicle only (*monorchids*) impotent (see *Case* below). Individuals in whom the testicles have not descended (*cryptorchids*) are not necessarily impotent; many, but not all, are, however, sterile (see *Cases* below, and over page).

Case.—**A nullity of marriage case.**—In the case of *L.* v. *L.*, it appeared that the woman was impotent, but that she might possibly be cured by an operation involving no great risk of life, to which, however, she refused to submit. The court, in granting the decree, said that it could not compel her to submit, and the man can only be expected to take all reasonable means to persuade her. This he has done, and she has distinctly refused (L. R. 7 P. Div. 16).—Tidy's *Leg. Med.*, II. p. 102.

Case.—**Procreation by cryptorchid.**—A man in whom the testicles had not descended at the age of 30, had been twice married, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service.—Taylor, *Med. Jur.*, II. p. 288.

Case.—**A similar case.**—Case of a man in whom the testicles had not descended, reported by Mr. Poland. This man married when he was 20, had two children by his first wife; and at the time of his admission into hospital (for hernia) had been married two years to a second wife.—*Ibid.*

Case.—**Procreation by a monorchid.**—"Willimet, the first wife of one John Bury, alleged that he was impotent; and on inspection by two physicians, he was found to have but one testicle, the size of a small bean, while she was a virgin. On this and other circumstantial evidence, the Ecclesiastical Court annulled the marriage. But Bury took a second wife, by whom he had a son."—Case of John Bury, temp. Queen Elizabeth, Guy, *For. Med.*, p. 48.

(4) **Disease.**—Local disease may cause temporary and remediable impotence; *e.g.* elephantiasis and large hydrocele, from mechanical obstacle to coition; and stricture of the

uretha, from mechanical obstruction to the flow of semen. Local disease may also cause permanent and incurable sterility, *e.g.* advanced disease of the testicles, or wasting of the testicles after inflammation; this last has been observed as a result of metastatic parotitis. Lithotomy has been known to cause sterility, probably from injury to the ejaculatory ducts.

Constitutional diseases, if of an exhausting nature, may produce temporary impotence; but general diseases, not affecting the brain or spinal cord, or not producing great debility, do not usually cause impotence.[1] Injury or disease of the brain or spinal cord may cause impotence or sterility. Curling relates several cases of impotence caused by blows on the head, especially on the back and under-part of it; in some cases of this class recovery takes place, but in others wasting of the testicles and permanent sterility follows.[2] Paraplegia from injury to or disease of the cord, according to Curling (and probably also locomotor ataxy) has no direct effect on the testicles, but may cause impotence by destroying the power to copulate. Wasting of the testicles and sterility may, however, follow. In one case quoted by Curling, a man suffering from paraplegia of some years' duration retained sufficient sexual power to have prolific intercourse. Hemiplegia may cause impotence, but Guy mentions two cases where men, within three weeks of an attack of hemiplegia, had sexual intercourse with their wives and begat children[3] (see *Case* below). Over-indulgence in certain intoxicating or narcotic drugs, *e.g.* alcohol, opium, cannabis, and tobacco, is said to cause sterility. Sterility has by some men been stated to occur in chronic lead-poisoning.

Case.—*Bagot* v. *Bagot* (Irish Probate Court, 1878), Dr. Radcliffe stated that he himself has seen cases of ataxy in which sexual capacity and fruitfulness were retained.—Guy, *For. Med.*, p. 49.

Case.—**Procreation after** an attack of hemiplegia.—"E. K., *æt.* 58, when 33 years of age, had a well-marked attack of hemiplegia of the right side, which has left him lame, and with his speech slightly affected. He alleges that he had connection with his wife within a week of his seizure, that his sexual powers have not been impaired, and that since his attack he has had three children always considered as his own. His wife gives three weeks as the extreme limit of time after the attack, at which connection took place."—Guy, *For. Med.*, p. 50.

(5) **Mental causes.**—Excess of passion, timidity, fear, etc., may cause temporary impotence. Individuals may, it is

[1] Taylor, *Med. Jour.*, II. p. 292. [2] *Ibid.*, p. 294.
[3] *For. Med.*, p. 49.

alleged, be impotent or sterile as regards a particular female, but not as regards others (see *Cases* below).

Case.—**Alleged impotence** in respect to one female, but not to others.—"In the reign of King James I. of England, the Earl of Essex was sued by his Countess for divorce on the ground that he was impotent. She claimed to be a *virgo intacta*, but is said to have substituted one of her maids for herself when examined. The Earl appears to have admitted the charge as regards the Countess, although he denied it *quoad* others." —Woodman and Tidy, *For. Med.*, p. 679, from Hargraves' *State Trials*, I. p. 315.

(6) **Drugs.**—Diuretics, carbonate of soda, etc., have a marked anaphrodisiac action. Quinine, by causing emissions, has a reputation for tending to impotence.

Sterility in the Female.

A female may be sterile owing to (1) extreme youth; (2) advanced age; (3) malformation or defect; (4) disease.

(1) **Extreme youth.**—According to the law of England twelve is the earliest age at which a female can contract a valid marriage; it would therefore appear that the law of England presumes that a girl attains puberty and becomes potent at the age of twelve, though she cannot give her consent to the sexual act till she is sixteen years of age. Age of Consent in India.—According to the law of India (*P. Code, s.* 375), any female over the age of twelve can give a valid consent to sexual intercourse; and "sexual intercourse by a man with his own wife, the wife not being under twelve years of age, is not rape." Hence it would appear that the law of India presumes that a female attains puberty and becomes potent at the age of twelve.

Commencement of Fertility is, as a rule, indicated by the commencement of menstruation. In a few cases, however, pregnancy has occurred before the appearance of menstruation, but no case of pregnancy at an earlier age than eight to nine has been recorded. Menstruation is not a sign of bodily maturity, it is in most cases merely a sign of puberty and ovulation with possible pregnability or capacity to conceive.

The **age** at which the menstrual function becomes established varies greatly with the individual and climate. Among natives of Europe the general age at which it first appears is fourteen to fifteen. Out of 2000 cases, menstruation appeared in 211 between the ages of ten and twelve, in 1462 between

thirteen and sixteen, and in 318 between seventeen and twenty. In one case only did it appear as early as nine, and in one only as late as twenty-two. Among natives of warm climates menstruation occurs earlier than among natives of temperate climates. Among natives of India menstruation so early as ten is uncommon, but its appearance is seldom delayed beyond the fifteenth year. The menstrual flow commonly lasts three to four and a half days. The menstrual period, reckoned from commencement of flow to commencement of flow, save in exceptional cases, is twenty-eight days.

The influence of Tropical Climate in causing early menstruation seems to have been over-estimated. In the following table are given the comparative results of observations at Calcutta in 3189 cases amongst European, Eurasian, and Indian-born girls as to the age at which menstruation first appeared. In the class of pure native Hindus and Mohammedans, but chiefly the former, the greatest percentage of dates for first menstruation occurs between the 12th and 14th years, amounting to 65·7 of the whole class. Eurasians approach the native type between the ages of 12 to 14 years, but diverge again towards the European type between 14 to 16 years of age.

Ages of First Menstruation in India in Years.

Race		10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Europeans ..	174	2·7	6·1	13·4	23·4	21·2	16·7	8·3	6·1	1·6
European, country-born	387	0·7	3·6	10·8	25·8	24·8	17·3	12·4	3·1	1·2
Eurasians ..	795	0·7	0·2	22·0	31·8	22·0	10·5	4·2	1·7	0·6
Natives	1752	2·0	10·4	36·4	29·3	13·9	4·5	2·2	0·2	0·04
Jewesses	73	—	2·7	9·5	34·2	34·2	17·8	1·3	1·3	—
Chinese	8	—	—	12·5	62·5	12·5	—	12·5	—	—
Total ..	3189	—	—	—	—	—	—	—	—	—

The cause of the earlier menstruation in hot climates seems partly due to the shorter duration of life, with its consequent earlier maturity, and partly to the *social* differences, whereby in the tropics, children early gain precocious knowledge of sexual matters, owing to the want of privacy in oriental domestic life. Thus an experienced observer states that it is doubtful "if there are any little boys and girls in native houses

in this country who have reached the age of ten years who do not have a very fair knowledge of what the sexual relations and child-bearing really mean." In addition, there is the precocious sexual excitement of too early marriages at the age of ten to twelve years, with its many possibilities of sexual intercourse, authorized by native customs, though now made illegal by British law.

(2) **Advanced age and Cessation of Menstruation.**—Menstruation usually ceases between the ages of forty and fifty, but has been known to cease as early as twenty-three. On the other hand, there are on record several cases of menstruation at over sixty years of age, and one as late as seventy-seven. As a rule fertility ceases with the cessation of menstruation, but Taylor [1] mentions a case of a lady aged forty-four who was delivered of her tenth child eighteen months after the entire cessation of the menses. No general rule can be laid down as to the age at which, in the female, fertility ceases.

The question whether a woman is past child-bearing is of practical importance in cases where money has been settled on or bequeathed to a woman absolutely, in case she has no children, but in case of having children, only for her life with remainder to her children. In these and similar cases, where the woman has attained an advanced age without having had children, it is presumed she is incapable of having issue, and she is held absolutely entitled to the money, in which, if she had children, she would only have a life interest. No particular age is fixed as the period when such presumption arises.

The earliest age on which such a presumption has been acted on is that of a woman aged forty-nine years and nine months (see *In re Millner's Estate*, L. R. 14 Eq., p. 245), but in that case she had been married for twenty-six years and there had never been any children. In the case of *In re Widdow's Trusts* (L. R. 11 Eq., p. 408) the presumption was acted on in the case of a widow aged fifty-five years and four months, and a spinster aged fifty-three years and nine months. In *Norton* v. *May* (9 Ch. Div., p. 388) the court refused to presume no possibility of issue in the case of a woman aged fifty-four years and six months, who, although she had been married several years, had separated from her husband soon after her marriage, and had only lived with him for about three years before the filing of the case in court. In *Davidson* v. *Kimpton* (18 Ch. Div., p. 213), the presumption was acted on in the case of a spinster in her fifty-fifth year. There is no similar presumption as to a male being incapable of begetting issue.

(3) **Malformation or defect.**—Complete absence or occlusion of the vagina of course causes impotence. Occlusion may

[1] *Med. Jur.*, Vol. II. p. 17.

be remediable by operation. For occlusion to act as a cause of sterility it must be complete; "the slightest aperture will often suffice for impregnation."[1] Many cases are recorded where during labour the vagina has been found occluded to so great an extent as to require incision in order to effect delivery. Ogston mentions a case of "a woman who had a vagina so narrow as scarcely to admit a quill," but who, after being married eleven years, became pregnant, when the vagina "dilated of itself sufficiently to admit of delivery at the full term."[2] Absence of the ovaries or uterus of course causes incurable sterility. In such cases, however, there may be no external defect or malformation, and the cause of the sterility may in consequence only be ascertainable after death.

(4) **Disease.**—Impotence or sterility in the female may arise from a variety of diseased conditions. There may, for example, be excessive irritability of the vagina, preventing coitus and causing impotence (see *Cases* below). Again, effective coitus may be prevented by ruptured perinæum, or recto-vaginal fistula. Sterility may result from disease of the ovaries; obstruction of the Fallopian tubes, or of the neck of the uterus; displacements of the uterus, etc., etc. Acid discharges from the vagina or uterus may cause sterility by acting destructively on the spermatozoa, or preventing their access to the ovum. Paraplegia in the female, it may be noted, does not always prevent either impregnation or delivery.[3]

Case.—**Hysteria a cause** of impotence in the female.—"In this case, where the parties had cohabited for two years and ten months, and the man's capacity and desire to consummate were not questioned, the court being satisfied of the *bona fides* of the suit, and of the practical impossibility of consummation in consequence of the hysteria of the woman, pronounced a decree of nullity, although there was no structural defect in the woman."—Tidy, *Leg. Med.*, II. p. 102, *G.* v. *G.*, L. R. 2 P. & D. p. 287.

Case.—**A similar case.**—"In a suit for nullity of marriage, it appeared from the husband's evidence that whenever he attempted to have intercourse with his wife the act had produced hysteria on her part; and that, although he had cohabited with her for more than three years, the marriage had never been consummated. The wife refused to submit to inspection. Decree *nisi* granted."—Tidy, *Leg. Med.*, II. p. 103. Case of *H.* v. *P.*, L. R. 3 P. & D. p. 126.

[1] Taylor, *Med. Jur.*, I. p. 302. [2] *Lect. Med. Jur.*, p. 85.
[3] Woodman and Tidy, *For. Med.*, p. 684.

CHAPTER XI.

VIRGINITY AND DEFLORATION.

One of the questions which may arise in nullity of marriage suits is as to whether a certain female is '*virgo intacta*' or not. The same question may also arise in other cases, *e.g.* (1) in divorce cases and defamation cases; (2) in cases where an unmarried female is alleged to be a prostitute, and as such liable to be dealt with under the Contagious Diseases Act, or other similar law (see *Case* below); (3) In rape cases. In these latter, however, it is not an essential question, seeing that vulval penetration is all that is necessary to constitute the offence of rape (see 'Rape'), and this may be effected without destruction of the signs of virginity. (See Figs. 22 to 25, pp. 272–3.)

Case.—**Two women** afterwards found to be prostitutes; result of examination as to virginity doubtful in the case of one.—Two young women, of genteel appearance, were attacked in the public streets by some young men, who called them opprobrious names, and told the passers-by that they were no better than common prostitutes. Some good-natured persons resented this conduct and took the girls' part, and a complaint was lodged on their behalf against their defamers, who were summoned before a magistrate. The defendants pleaded a justification, while the females, on the contrary, stoutly insisted on their purity, and even offered to submit to inspection by a medical examiner, which the opposite party dared them to do. A sworn inspector, clever and conscientious, was appointed by the magistrate, and reported that it was totally out of his power to say anything certain as to one of the females; she might or might not be a virgin; but that the other had probably had some intercourse with men, though he could not assert the fact positively. Yet it subsequently came out that these young women had actually been for some time on the registers of the police, and had both had repeated attacks of the venereal disease.—Guy, *For. Med.*, p. 56, quoted from Parent-Duchatelet.

1. **The Hymen.**—The most reliable sign of virginity is an intact hymen.

(1) *Is the hymen always present?*—At one time it was alleged by many authorities that the hymen was frequently absent. This view has, however, been proved by later observations to be erroneous. It was found, for example, to be present in each one of the 650 cases examined by Devilliers, Orfila,

and Tardieu.[1] Capuron, however, records a case of congenital malformation of the genitals with absence of the hymen.[2]

(2) *What is the natural condition of the hymen in the virgin?*—Practitioners often have the most vague conception of the hymen and mistake for it the thin margin of the fourchette. Powell's practical directions for its examination are given in Appendix VIII. A very common form of the membrane, after the age of infancy especially, is that of an irregularly circular diaphragm, broken at its upper third by an opening more or less large and placed more or less distant from the lower border of the vaginal orifice. In a third set of cases the hymen has been described in late observations as a sort of diaphragm, exactly and regularly circular, pierced by a central opening. A fourth form assumed by it, and that its most common appearance, is that of a semicircular fold of integument stretched across the lower border of the vaginal orifice, its free border concave and notched (*échancré*), and its extremities losing themselves in the labia minora. Lastly, the hymen has been occasionally encountered in the shape of a mere narrow fringe around the entrance to the canal of the vagina; in one case as a sort of bridle across the vagina, with a passage on each side; in another as a complete septum, pierced by numerous minute openings; and in a third instance as a double septum, without any opening whatever into the vagina. The entrance to the vagina is thus practically closed or narrowed by the hymen, which in early life is most usually vertical, but by the natural development of the parts gradually assumes a horizontal direction. Towards puberty more firm and consistent than in early life, as menstruation becomes established it becomes more or less flaccid, presenting less resistance to their flow, and is more easily lacerated.

(3) *What changes are produced* in the hymen by sexual intercourse?—As a general rule, when sexual intercourse takes place, the hymen is lacerated or ruptured, in the latter case giving rise to "those small pyramidal tubercles, from three to six in number, known as the carunculæ myrtiformes."[3] If, however, the aperture in the hymen be larger than usual, or the membrane itself be lax, repeated intercourse may take place without rupture or even laceration. Many cases are recorded, in fact, where the hymen has existed all through pregnancy, and has only ruptured at the time of delivery. In very young children the hymen, owing to its deeply seated position, and to the narrowness of the parts,[4] is not usually even lacerated by intercourse.

[1] Ogston, *Lect. Med. Jur.*, p. 102.
[2] Tidy, *Leg. Med.*, II. p. 97.
[3] Guy, *For. Med.*, p. 55.
[4] *Leg. Med.*, II. p. 201.

Case.—**Hymen is present,** and apparently intact, in prostitutes, etc. —At Martineau's service in the Broca (then Lourcine) Hospital in Paris, I saw a girl who had come to the out-patient department for treatment of what was to all seeming an insignificant leucorrhœa. There was no obvious urethritis, nor were Skene's tubules affected, a point to which Martineau used to pay particular attention, and there was present a hymen whose orifice was barely two millimetres in diameter. But this girl was suffering from gonorrhœa, and admitted that she had infected several of her customers, she being a clandestine prostitute of the purlieus of the Sorbonne. She had been on the town for over a year, and had entertained as many as five men in a single afternoon on a *fête* day. Her hymen was elastic, and admitted of the passage of a large rectal bougie,

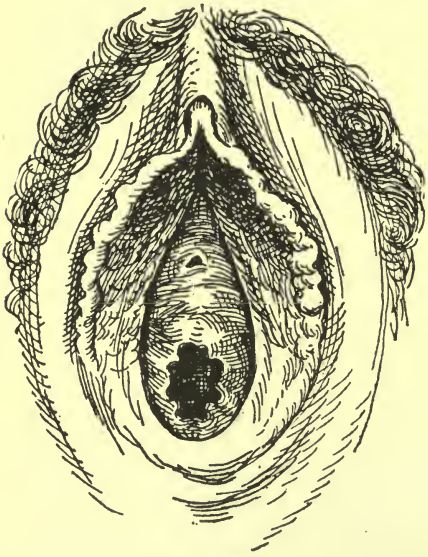


FIG. 22.—Intact Hymen, circular, with Natural Notches.
(From Peterson and Haines' *Legal Medicine.*)

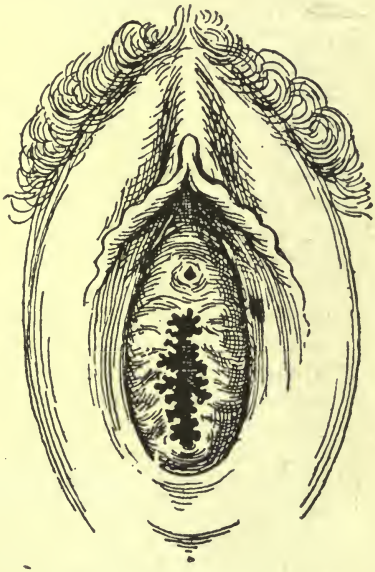


FIG. 23.—Intact Hymen, fimbriate.
(From Peterson and Haines.)

returning to its obturator-like condition, when this was withdrawn.—W. D. Sutherland, *Ind. Med. Gaz.*, 1902, 245. See also *Case* below.

The hymen may be ruptured, on the other hand, by the introduction of foreign bodies other than the penis, *e.g.* (1) accidentally,—this, however, is extremely rare; or (2) by the introduction of instruments during an examination or surgical operation; or (3) in practising masturbation, especially if the body introduced is of large diameter; or (4) in endeavours to dilate the parts of young females, so as to render them *aptæ viris:* Casper mentions a case where the mother of a girl aged ten employed first her fingers and then a long stone for the purpose,

thereby lacerating the hymen;[1] and Chevers mentions the use in India for this purpose of the fruit of the plantain, and also of pieces of sola pith, the girl being made to sit in water, so that the pith may swell and dilate the parts.[2]

It has also been asserted that the hymen may be ruptured by indirect violence in a fall, or during violent exertion; this appears, however, to be very doubtful.

(4) **Can virginity** or non-virginity be inferred **from the condition of the hymen?** If the hymen is intact (not even

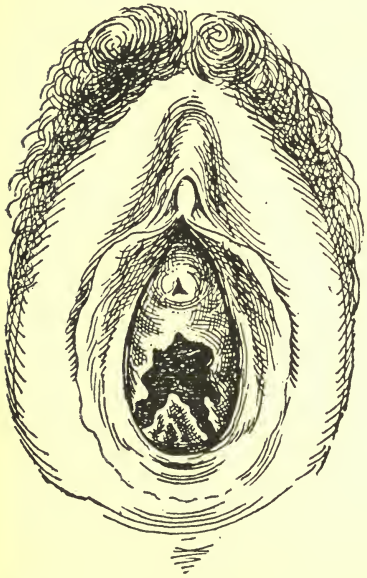


FIG. 24.—Ruptured Hymen, crescentic, with two Lateral Lacerations.
(From Peterson and Haines' *Legal Medicine.*)

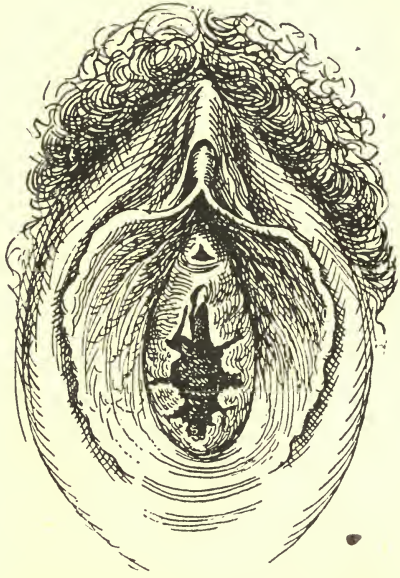


FIG. 25.—Ruptured Hymen, circular torn in Several Places.
(From Peterson and Haines.)

lacerated), the probabilities, except in the case of females below the age of puberty, are very strongly in favour of virginity; and the inference of virginity becomes almost certain if the membrane is normal in position and structure, and its aperture is of small size and undilatable; and if accompanying this condition of the hymen the other signs of virginity (see below) are present.

Case.—**Evidence of virginity** in disproof of alleged adultery.—It was alleged by defendant that the plaintiff, a married man, had had

[1] Taylor, *Med. Jur.*, II. p. 430.

[2] *Med. Jur.*, p. 689.

adulterous intercourse with a young woman, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. The late Dr. Ashwell was called upon to examine the woman, and he deposed that, in his opinion, she was a virgin, and had never had a child.—Taylor, *Med. Jur.*, II. p. 441; *Frazer* v. *Bayley*, Common Pleas, Feb., 1884.

Case.—**A similar case.**—In this case, which involved an action for defamation of character, the plaintiff, a married man, *æt.* 64, had been charged with committing adultery with a certain woman. Several witnesses for the defendant positively swore that they had seen these persons in carnal intercourse. This was denied by the plaintiff; and as an answer to the case, medical evidence was tendered to the effect that the woman, with whom the adulterous intercourse was alleged to have taken place, had been examined, and the hymen was found intact. In cross-examination, however, this was admitted not to be a conclusive criterion of virginity, and a verdict was returned for the defendant.—*Ibid.*, *Delafosse Fortescue*, Exeter Lent Assizes, 1853.

On the other hand, the absence of an intact hymen, although strong evidence of non-virginity, cannot be taken as conclusive proof thereof, seeing that, as already stated, the hymen may be ruptured or lacerated by the introduction of foreign bodies other than the penis.

Other signs of Virginity.—(1) The *Breasts.*—These in young adults are hemispherical, plump, and elastic, but a single act of coitus is unlikely to alter this. (2) The *Vagina* has a narrow and rugose condition, the clitoris unenlarged, and the labia elastic and in close contact. (3) The *Fourchette* present (though it is not usually ruptured on first connection). (4) Absence of signs of previous delivery, of fourchette and perinæum entire. All such signs, taken by themselves, are unreliable as evidence of virginity, but are useful as corroborating evidence of virginity derived from the condition of the hymen.

Signs of Loss of Virginity.—These are the absence of the above signs of virginity and are:—(1) Torn hymen, (2) signs of injury, and (3) signs of implanted venereal disease—though all of these may be accounted for otherwise than by sexual intercourse.

CHAPTER XII.

PREGNANCY IN RELATION TO CRIME AND LEGITIMACY.

Age of Marriage for Hindus.

> "If a man marry, he must select a maiden who is of a third of his age."—*Vishnu Purāna*, 3, 10; Wilson's ed., 3, 101.
>
> "Let a man of thirty years wed a lovely maid of twelve; or a man of twenty-four a maid of eight. If his virtue is being impaired let him be expeditious."—MANU, *Institutes*, 9, 94.
>
> "The marriage for all castes of a girl after her seventh year is commended, O king. Her marriage otherwise is reprobated by the law."—*Mahā Bhārata*, cited in Colebrooke's "Digest of Hindu Law," 3, 328.

THE law may request (*it cannot order*) a medical man to examine a woman to ascertain whether or not pregnancy exists, for the following reasons:—

(1) *To respite a woman condemned to be hanged or to hard labour.*—When pregnancy is pleaded in bar of an execution in India, owing to the wording of *s.* 382 of the *Cr. P. Code*, the question to be decided is simply, Is the woman pregnant or not? In England, however, owing to the terms of the charge to the jury of matrons, a medical man called in to their assistance may have to examine into the further question, Is the woman "with child (pregnant) of a quick child."

(2) *The birth of a posthumous heir by a widow.*—Where a widow is suspected of feigning pregnancy in order to ultimately produce a supposititious heir to an estate of which her husband died possessed.—In such a case, according to the law of England, the heir-presumptive to the estate, *i.e.* the person who would succeed thereto, supposing the woman not to be pregnant, may apply to the court to order an inquiry to be made into the alleged pregnancy. The court, if it grants the application, does so by issuing what is technically called a writ "de ventre inspiciendo."

(3) *To increase damages in a seduction case.*

(4) *To disprove libels in charges of adultery, etc.*—The woman alleged to be pregnant may be a married woman living apart from her husband, and the allegation may be put forward in support of a suit for divorce. Or she may be an unmarried female or a widow, who has been defamed and seeks to avoid disgrace.

(5) *In cases of alleged abortion.*—An attempt to cause miscarriage is an offence, irrespective of whether the woman be or be not pregnant. Further, according to the law of India (but not according to that of England), to cause, or attempt to cause, a woman "quick with child" to miscarry, is a graver offence than if she be not quick with child.[1] Hence, in India, in these cases the question may arise, whether or no a certain female was "quick with child" at a particular time. (See 'Causing Miscarriage.')

(6) *As motive in suicide and murder.*

Cases.—**Pregnancy a motive** for murder or suicide.—(*a*) A widow seven months gone with child died rather suddenly; an inquest was held by the police, and a verdict returned of death from dysentery. Suspicion, however, being excited, a *post-mortem* examination was ordered, the result of which was the discovery of the pregnant condition of the woman (which had been concealed in the inquest report furnished by the police), and of the fact that the cause of death was arsenical poisoning. The district magistrate remarks, in reference to this case, that there is every reason to believe that all engaged in the inquest tried to conceal the true cause of death.—*Bo. Chem. An. Rep.* for 1884, reported by the District Magistrate of Bassim, Hyderabad Assigned Districts.

(*b*) In this case, which occurred in the Surat district, as in above case, the cause of death was arsenical poisoning, and the deceased was a widow far gone in pregnancy. The brother and sister of the deceased confessed to having given her eight annas' worth of opium in order to procure abortion or to cause death, so as to avoid the disgrace arising out of her condition. No opium, however, could be discovered in the viscera of the deceased.—*Ibid.*

(*c*) Alla Bux, of Purneah, was convicted of murdering his brother's widow. He confessed that, having administered drugs to her in order to cause her to abort, and having failed, he and others took her to a river-bank, put a cloth into her mouth, held her down, and murdered her by cutting her throat.—Chevers, *Med. Jur.*, p. 733.

(*d*) Case of poisoning by arsenic reported by medical officer, Tatta, Sind.—"Deceased was promised in marriage to a man of her caste (Mussulman), but before marriage she cohabited with him and became pregnant, and was advanced to above the fourth or fifth month, when her parents, to avoid disgrace, it is said, tried very much to procure abortion, but failed (much against her intended husband's will); so having failed to procure abortion, her parents, to save their reputation, it is suspected, gave her poison in her food."—*Bo. Chem. An. Rep.*, 1876–77, p. 18.

Signs of Pregnancy. — These may be divided into:—(1) Probable and (2) Certain signs.

[1] *I. P. Code, s.* 312.

Probable Signs.—(1) *Quickening.*—This obviously cannot be relied on for forensic purposes. Apart, however, from any wilful endeavour to deceive, a woman may be mistaken as to her condition. She may mistake, for example, symptoms of organic disease for symptoms of pregnancy. Cases are also recorded where, no organic disease being present, symptoms closely simulating those of pregnancy ('spurious pregnancy'), and, in exceptional cases, of labour also, have appeared. Again, a pregnant woman attributing her symptoms to disease, may be unaware of her condition, and remain so, even up to the time of her delivery. Further, as impregnation is independent of volition on the part of the female, conception may occur as the result of intercourse effected with her while in an insensible condition, and in such a case a woman may be unconscious of the fact that she is pregnant, and, it is possible, remain so up to the time of her delivery.

(2) *Cessation of menstruation.*—This sign is open to several fallacies. Menstruation may cease owing to causes other than pregnancy. A discharge of blood simulating menstruation may occur during pregnancy. Again, a woman may feign or deny menstruation in order to conceal her condition.

(3) *Morning sickness* is a common symptom, but it may, however, arise from causes other than pregnancy.

(4) *Changes in breasts.*—The breasts enlarge, become firmer, and secrete milk. A dark circle (areola), varying in width from half an inch to three inches, studded with glandular follicles, develops around the nipple. These appearances may, however, arise from causes other than pregnancy, or may continue after delivery. Hence they may be present in a non-pregnant female. Again they may be absent in pregnancy.

(5) *Enlargement of abdomen and changes in uterus.*—The cervix becomes full, round, soft, and elastic, and the os loses its transverse shape, and becomes circular, and its edges become soft and indistinct. Up to the end of the third month, the uterus not having risen out of the pelvis, the cervix is low down in the vagina and easily reached, and no enlargement of the abdomen is perceptible. After this the uterus begins to rise, and the cervix to shorten, recede, and become indistinct. About the end of the fourth month the enlarged uterus begins to be perceptible above the pubes, and rises to—between the pubes and umbilicus during the fifth month; the umbilicus during the sixth month; halfway between the umbilicus and the lower end of the sternum during the seventh month; and to the ensiform cartilage during the eighth month. As similar changes may take place owing to enlargement of the uterus from causes other than pregnancy, more reliance is to be placed

on their absence as a negative sign, than on their presence as a positive sign of pregnancy.

Certain Signs.—(1) *Passive movement of fœtus* (*Ballotement*).—This sign is not available until the end of the fourth month. It consists in the detection of a solid body floating (in the liquor amnii) in the uterus.

To obtain it, the woman—her bladder and rectum having been previously emptied—should be placed in the upright position; or recumbent, with the shoulders much raised. One or two fingers of one hand are then to be introduced into the vagina, and applied to the point of the cervix. The other hand is steadily pressed on the abdomen over the uterus. A jerk upwards is then given with the fingers in the vagina, when a hard body will be felt to recede from, and in three or four seconds fall back on, the fingers. After the end of the sixth month this sign is rarely available, the fœtus, from its bulk, not floating freely enough in the liquor amnii. Care must be taken to keep the fingers in contact with the cervix, otherwise a movement of the uterus itself may be mistaken for the movement of the fœtus within it.

(2) *Sounds of fœtal heart.*—This, the most certain of the signs of pregnancy, is described as resembling the ticking of a watch heard through a pillow. The pulsations vary from one hundred and twenty to one hundred and sixty a minute, and are not synchronous with the mother's pulse. A double sound is heard at each pulsation.

The sounds are generally, but not always, in normal presentations heard about midway between the umbilicus and one or other of the anterior superior spines of the ilium; they seldom can be heard earlier than the end of the fifth month, and in every case should be heard after the seventh month. If detected, the existence of pregnancy is certain, but pregnancy may exist and the sounds not be detected (*a*) owing to the examination being made at too early a stage; (*b*) owing to the death of the fœtus; or (*c*) owing to want of skill on the part of the auscultator. Ogston records a case where owing to ascites the sounds could not be detected by a skilled auscultator.

When any doubt exists it is always better to give the individual the benefit of the doubt. After death, the discovery of an ovum or fœtus in the uterus is, of course, an unequivocal sign of the existence of pregnancy. For the characters of the ovum or fœtus at various stages of gestation, see table, p. 294. The presence also of a corpus luteum in the ovary may afford corroborative evidence.

'Quickening.'

The whole question of 'Quickening' as regards Indian Law is in relation to Section 312, Indian Penal Code.

The term '*quickening*' is applied to certain peculiar sensations experienced by the mother at a certain stage of pregnancy. These sensations are often accompanied by constitutional disturbance, and are popularly ascribed to the first perception by the mother of the movements of the fœtus. They are most probably due to this cause, perception of the movements probably first occurring when the uterus comes into contact with the abdominal wall. These sensations may be felt as early as the twelfth week, are generally first felt between the fourteenth and twenty-fourth week, but in some cases are not felt at all during pregnancy. A woman who has felt these sensations is said to have quickened. These two terms, 'quickening' and 'quickened,' are derived from the word 'quick,' used in its old signification, namely, 'living.' Their use with reference to these sensations, arises from the old popular belief that their occurrence denoted the first accession of life to the fœtus. As, however, a fœtus is actually alive from the moment of conception, two interpretations may be assigned to the word 'quick' when applied to a fœtus *in utero*: (1) The more extended interpretation, namely, that the fœtus is alive; or (2) The more restricted interpretation, namely, that the mother has experienced the sensation known as quickening.

As regards the first of the two phrases in question, viz. "with child of a quick child," there appears to be no doubt but that this has always been used in law as if the more restricted meaning attached to the word 'quick.' Some doubt, however, has been thrown on the interpretation accepted by English legal authorities of the second phrase, viz. "quick with child," owing to the remarks made by Baron Gurney in the case of *R.* v. *Wycherley* (8 C. & P. 262). In this case pregnancy having been pleaded in bar of execution, the jury of matrons were directed to try whether the prisoner was "quick with child or not." Subsequently Baron Gurney addressed a medical witness called to the assistance of the jury of matrons as follows: "Quick with child is having conceived; with quick child is when the child has quickened. Do you understand the distinction?" Baron Gurney, therefore, in the case directed the medical witness to take the expression "quick with child" as if the more extended meaning attached to the word 'quick.' This, however, is contrary to the law as stated by Blackstone, who says: "If they (the jury of matrons) bring in their verdict quick with child—for barely with child, unless it be alive in the womb, is not sufficient—execution shall be staid." . . . "But if she (the prisoner) once hath had the benefit of this reprieve, and been delivered, and afterwards become pregnant again, she shall not be entitled to the benefit of a further respite for that cause. For she may now be executed before the child is quick in the womb." In the I. P. Code also, the expression "quick with child" is clearly used as if the more restricted meaning attached to the word 'quick.' Section 312, for example, makes causing miscarriage, if the woman be "*quick with child*," a graver offence than simply causing miscarriage, thus implying that the condition "quick with child" is one which arises at a period subsequent to conception.

When, therefore, the question arises, is a certain woman "with child of a quick child" (or "quick with child"), what has to be determined is whether or not the woman has quickened. Quickening, however, is a sensation only felt by the mother. Still, if a medical man has, on examination, felt the actual movements of the fœtus, he is justified in assuming that the mother has also felt them, and that therefore she has quickened. Should he be unable to detect the active movements of the fœtus, he can only, in answer to the question, Has this woman quickened? state his opinion as to whether or no (1) The woman is pregnant; (2) The child is alive; and (3) The pregnancy has advanced to, or beyond, the stage at which the sensation of quickening is usually experienced; leaving it for the court to decide whether his answers do or do not amount to an affirmative answer to the question, Has this woman quickened? In giving an opinion on the last of the three above-mentioned points, a medical witness should bear in mind that quickening does not occur at any fixed period; it may occur at any time between the twelfth and twenty-fourth week. Further, it may be noted, that of the two cases in which the question of quickening arises, namely, the English case of pregnancy pleaded in bar of execution, and the Indian case of causing miscarriage; in the first the prisoner is benefited by being found "quick with child," while in the second a similar answer has the reverse effect.

The medical witness cannot say if the woman has felt quickening. She is the only competent witness to her own feelings. If, however, he (1) undoubtedly feels the movements of the child, (2) hears the fœtal heart sounds, he is justified in saying she is pregnant of a quick, *i.e.* a living, child.[1] Otherwise he can only say (1) she is pregnant, (2) the pregnancy has reached the stage at or before which quickening usually takes place.

[1] Many women have never felt quickening in their pregnancies.

CHAPTER XIII.

BIRTH AND DELIVERY *re* INHERITANCE.

BIRTH or delivery is a more frequent medico-legal question than pregnancy. It arises when the right to inherit property or a title is in dispute. Thus when the succession is fixed in the male line to the exclusion of the female line, the question may arise, Of what sex is a certain individual? (See 'Sex,' p. 35.) Again, as by law children born "without the shape of mankind" cannot inherit, the question may arise, Has this child "the shape of mankind"? More commonly are the cases where the right to inherit is disputed, on one or other of the following grounds:—(1) That the claimant is not a legitimate child; and with the medico-legal questions which arise in such a case, we may consider those which arise in 'affiliation' cases; (2) that, as in 'tenancy by courtesy' cases, a certain child was not born alive; (3) that the claimant is a supposititious child.

Legitimacy.

Children are either **'legitimate'** or **'illegitimate,'** which is also called **'bastard.'** Only legitimate children are regarded by law as the children of their father. These, therefore, possess certain rights which illegitimate children do not possess. According to the law of most countries, only such children are held to be legitimate as are either born or begotten during the existence of a valid marriage (lawful wedlock) between their parents. By the law of Scotland, however, children born before marriage become legitimate on the subsequent marriage of their parents. Further, according to the law of England, any child born or begotten during lawful wedlock is presumed to be legitimate until the contrary is shown; (*a*) by proof of the impotence of the alleged father of the child; or (*b*) by proof that the parties to the marriage had no access to each other at any time when the child could have been begotten. The presumption, as to legitimacy, of the law of India is embodied in *s.* 112 of the Indian Evidence Act, and is as follows: "The fact that any person was born during the continuance of a valid

marriage between his mother and any man, or within two hundred and eighty days after its dissolution, the mother remaining unmarried, shall be conclusive proof that he is the legitimate son of that man, unless it can be shown that the parties to the marriage had no access to each other at any time when he could have been begotten."

Access in Legitimacy Cases.—The courts in India would no doubt construe the 112th section of the Evidence Act in accordance with the English decisions. It will be noticed that the 112th section does not in terms refer to the presumption being rebutted if the husband be impotent, but proof of such impotency would negative the fact of 'access' in the sense in which it is submitted the word is used in the above section.

The English law on this subject is to be found in the answers given by the judges to questions put to them by the House of Lords in the *Banbury Peerage Case* (1 S. & S., 155, A.D. 1811). The law, as then stated, was recognized in a subsequent case, in the House of Lords, in 1837 (*Morris* v. *Davis*, 5 Cl. & F., p. 163), and is as follows:—(1st) That when the husband and wife have opportunities of access, the presumption of legitimacy may be rebutted by circumstances inducing a contrary presumption. (2nd) That non-access or non-generating access may be proved by means of such legal evidence as is admissible in every other case in which it is necessary to prove a physical fact. (3rd) That after proof of sexual intercourse evidence will not be admitted, except to disprove the fact. (4th) That sexual intercourse is presumed, unless met by such evidence as satisfies those who are to decide that it did not take place.

By 'access' is meant sexual intercourse, and not such intercourse as is understood by being in the same place or in the same house (*Banbury Peerage Case; Morris* v. *Davis*). Although possibility of such access may be proved, yet if the court is satisfied, from legal evidence, that no sexual intercourse did take place, the presumption of legitimacy is rebutted. In the case of *Aylesford* v. *Aylesford*, reported in the *Times* of July 3, 1885, the husband and wife were both living in London during the period, or some portions of the period, when the child whose legitimacy was in question could have been begotten. The circumstances of the case negatived the probability of intercourse between the husband and wife, although it was possible. The child was found, by the House of Lords, to be illegitimate. In the case of *In re Westhead's Trusts* (*Times*, July 29, 1885), there was no evidence where the husband was during the critical period during which the child could have been begotten. He, however, had at that time taken divorce proceedings against his wife. The Court of Appeal held that the circumstances of the case negatived any probability of intercourse between the husband and wife, and, being satisfied it had not taken place, held the child to be illegitimate.

In the case of *Rex* v. *Inhabitants of Mansfield* (1 Q. B. 444), the Court of Queen's Bench determined that the non-access of the husband might be proved by circumstances, "one of which," it was said, "certainly is adulterous intercourse between the husband or wife and another party." In that case the whole proof consisted only of that single fact, and it was held not sufficient to rebut the presumption. The parties, however,

were in a low class of life, the wife being a pauper, circumstances which Kay, J., in *Hawes* v. *Draegen* (23 Ch. Div. p. 173), said must be taken into consideration in determining whether the presumption is rebutted.

Hence, the legitimacy of a child may be disputed on either of two grounds, namely, (1) that the alleged father of the child is impotent; or (2) that the parties to the marriage had no access to each other at any time when the child could have been begotten. The following examples show the medico-legal questions which may arise when legitimacy is disputed on the second of these two grounds.

1. A husband on a certain date ceases to have access to his wife; after a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the interval between the last access of the husband and the birth of the child was greater than the utmost period to which gestation can be prolonged.

2. The parties to a marriage are proved, after a long period of separation, to have resumed access to each other on a certain date. After the lapse of a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the period intervening between the date of resumption of access and the date of the child's birth was so short, that the child must have been begotten before access was resumed. If in such a case the appearance of the child at birth indicates it to be a mature child, the question arises, What is the shortest natural period of gestation? or if the child is an immature child, what, judging from its appearance, was its uterine age at the time of its birth (see pp. 291 *f.*)? Again, in such a case it may be alleged that the mere fact that the child was born alive and capable of being reared, proves that its uterine age at birth was greater than the interval which elapsed between resumption of access and birth, thus raising the question, What is the earliest period of gestation at which a 'viable' child can be born, *i.e.* one capable of living and being reared? Moreover, as a portion of the evidence bearing on the question of early viability is derived from cases where a viable child has been born a short time after a previous delivery, and as such cases may be accounted for by 'superfœtation' (*i.e.* conception of a second ovum during gestation of a first), the further question arises, Is superfœtation possible?

It may be here remarked that, as his wife's adultery is a ground on which a husband may claim a divorce, questions similar to those arising in cases of contested legitimacy may arise in suits for divorce. The question as to the degree of maturity of a child may also arise in cases where a child is

born soon after marriage, and where it is alleged that the parents must in consequence have had sexual intercourse before marriage, and are therefore of immoral character (see following case).

Case.—**A viable child** born one hundred and seventy-four days after marriage. The Rev. Mr. Jardine was married on the 3rd of March, 1835, and on the 24th of August following his wife was delivered of a girl, who, supposing her to have been the fruit of sexual intercourse on the day of the marriage, was only one hundred and seventy-four days, or five calendar months and twenty-one days old. The infant, which was undoubtedly immature, though to what degree could not be determined, died on the 20th of March, 1836, having survived about seven months. On this Mr. Jardine's parishioners brought a charge of incontinency against him before the General Assembly of the Church of Scotland, alleging that he must have had intercourse with his wife before marriage. The main question in the case was:—Was it possible that a child not more than one hundred and seventy-four days old at birth, could be maintained alive for seven months? The court found the charge 'not proven.'—The Jardine Case: Guy, *For. Med.*, p. 127.

Affiliation cases.—Although illegitimate children are regarded by law as the sons of nobody, their father is bound to contribute towards their support until they have attained a certain age. Hence, a woman having been delivered of an illegitimate child, may appear before a court and claim that a certain individual, who she alleges is the father of her child, may be compelled to so contribute. Such cases are called 'affiliation cases,' and in them questions may arise similar to those arising in cases of contested legitimacy. In affiliation cases also the further question may arise, Can any opinion as to the paternity of the child be formed from its resemblance or non-resemblance to its alleged father?

Tenancy by courtesy.—By the common law of England, if a man survived his wife, and he had issue by her born alive, that might by possibility inherit the estate as her heir, the husband so surviving became entitled to an estate for the residue of his life in such lands and tenements of his wife as she was solely seised of in fee simple, or fee tail in possession. The husband, while in enjoyment of this estate, is called a tenant by the courtesy of England, or, more shortly, tenant by courtesy.[1]

To establish this tenancy by courtesy, the child must be born during the existence of this marriage, and hence, although the right accrues to the husband if the child is extracted by Cæsarean section during the mother's life, it does not accrue if the child is so extracted after her death, for in that case the marriage has ceased to exist before the birth of the child. Further, the child must have been completely born, and must, after complete birth, have manifested some sign of life; the slightest sign

[1] Williams on *Real Property*, p. 274.

of life, however, a mere tremulous motion of the lips, for example (see following *Case*), has been held by the English courts sufficient to establish the fact of live birth in these cases.[1] Much stronger evidence of live birth is, however, required in cases of infanticide (see 'Infanticide'). As in a case of disputed right to tenancy by courtesy, it may be alleged in opposition to the claim, that the child, when born, was so immature that it could not possibly have manifested any sign of life after birth; the question may arise in these cases, What is the earliest period of gestation at which a child can be born capable after birth of manifesting signs of life?

Case.—**Proof of live birth** in a tenancy by courtesy case.—The wife of the plaintiff, who was possessed of an estate in her own right, died after having given birth to a child. The child was supposed to have been born dead, and the estate was surrendered to the defendant, her heir. Ten years afterwards facts came to the knowledge of the plaintiff which led him to believe that the child was born alive, and that he had therefore wrongfully surrendered the estate. The evidence of live birth was as follows: it was proved that the accoucheur in attendance (who had died before the trial) had, an hour before the child was born, declared it to be alive, and ordered a warm bath to be prepared for it. Further, two women, who after the child was born placed it in the bath, swore that they twice saw a twitching or tremulous motion of the lips of the child. This motion of the lips was the only sign of life observed, but it was held sufficient to establish the fact of live birth.—*Fish* v. *Palmer;* Taylor, *Med. Jur.*, II. p. 207.

It is possible that a claim to be tenant by the courtesy might arise in India, as there are estates held in India subject to the English Law of Inheritance (see remarks of Mr. Justice Pontifex in case below). No such claim, however, could be made by any one whose marriage had taken place since the 31st of December, 1865, as *s.* 4 of the Indian Succession Act, 1865, enacts that no person shall by marriage acquire any interest in the property of the person whom he or she marries. That section, by s. 331, is not applicable to marriages contracted before the 1st January, 1866.

Case.—**Tenancy by courtesy in India.**—In this case the widow of an Armenian, married before the Dower Act 29 of 1839, was held to be entitled to dower out of her husband's lands. In the course of the argument, Pontifex, J., remarked: "It would take away from the mutuality of contract between husband and wife to hold that the widow is not entitled to dower as against a purchaser from her husband. The husband is entitled to an estate by the courtesy of his wife's lands."—*Sarkies* v. *Prosonomoyee Dossee*, I. L. R., 6 Calc., p. 794.

Supposititious children.—By a supposititious child is meant a child produced by a woman who avers it to be hers when it is not. In these cases the motive is generally to further an attempt either to extort money or to divert

[1] The Scotch courts require, in order to establish the fact of live birth in civil cases, proof of commencement of respiration (Ogston, *Lect. on Med. Jur.*, p. 182). For crying as a proof of birth, see 'Infanticide,' Chap. XVI.

succession to property. A supposititious child may be one (1) produced by a woman who has never been delivered of a viable child, or (2) produced by a woman in substitution for a child of her own. In case (1), besides questions similar to those occurring in legitimacy cases, the following additional questions may arise: (*a*) Is this woman sterile? and (*b*) does this woman show signs of having been recently or previously delivered of a viable child? In case (2) it is very seldom that medical evidence can afford any assistance. In both cases, as in affiliation cases, the question of how far the paternity of a child can be inferred from its resemblance or non-resemblance to its alleged parents may also arise.

Case.—Slingsby baby, 1916.

Inheritance.

The chief medico-legal questions which may arise in cases of disputed right to inherit are: (1) Is a certain individual impotent or sterile? This question has already been considered (see 'Impotence and Sterility'). (2) What is the natural period of human gestation? (3) How far may this period be prolonged? (4) Is superfœtation possible? (5) What is the earliest viable age? (6) What are the characters of children born at various periods of gestation? (7) How far may the paternity of a child be inferred from its resemblance or non-resemblance to its alleged parents? (8) Has this woman ever been delivered of a viable child?

The Average Period of Human Gestation?—The duration of gestation may be estimated by: (1) Observation of the period intervening between cessation of menstruation and delivery; and (2) observation of the period intervening between a single coitus and delivery. Of these two methods the first cannot be relied upon to give precise results, because (*a*) menstruation may cease from causes other than pregnancy, or may continue after pregnancy has commenced; and (*b*) impregnation may occur at any period during the menstrual interval. The second method, although more precise than the first, also cannot be relied on to give accurate results, because impregnation is not necessarily coincident with coitus, but may occur as long thereafter as the spermatozoa retain their vitality, which they may do for several days after emission. The duration of natural gestation appears to be not a fixed period, but one subject to variation within certain limits. Guy, for example, states that of fourteen authentic cases in the human subject, in which the duration was ascertained by reckoning from a single coitus, the minimum duration was

270, the maximum 293, and the average 284 days.[1] Again, Wharton and Stillé give a table of all the authentic cases of this kind in the human subject they have been able to collect.[2] Their table includes fifty-six cases, and shows a range of duration of from 260 to 296 days, with an average of 276 days.

The view that the duration of pregnancy is not a fixed period is supported by the results of observations on the lower animals. Thus from three series of observations on cows, the minimum period in these appears to be 241 days, and the average period 280 to 285 days: but in one series[3] (160 animals) a period of 308 days was observed; in the second series[4] (764 animals) a period of 313 days was noted; and in the third[5] (1105 animals), in four delivery took place in the forty-eighth week, equal to a duration of over 329 days; and in one in the fifty-first week, equal to a duration of over 350 days. Again, a series of 102 observations on mares[6] gave a range of 311 to 394 days, with an average of about 340 days; and another on 177 sheep,[7] duration of 145 to 171 days, with an average of 150 days.

How long may Human Gestation be prolonged?—The chief considerations bearing on this question are as follows:—

1. Of the fifty-six authentic cases collected by Wharton and Stillé, in which the duration of gestation was fixed from a single coitus, in nineteen the duration was over 280 days, and in two of these it was 291, and in three others 296 days.

2. In exceptional cases, where the commencement of pregnancy has been fixed by the death or absence of the husband or male, a longer period than 296 days has been recorded. Thus Guy, on the authority of Hewitt, quotes a case in which the duration of pregnancy, as fixed by the sudden death of the husband, was 308 days; and in two less satisfactory American affiliation cases, in which the commencement of pregnancy was fixed by date of last intercourse, the alleged duration was respectively 313 and 317 days. In both these cases the court decided in favour of the plaintiff, thus admitting the possibility of prolongation of pregnancy to the periods stated.

3. In a very large number of cases recorded by various authorities, in which the duration of pregnancy was estimated from the last day of menstruation, the longest period recorded was 325 or 326 days. As, however, conception may occur at almost any period during a menstrual interval, these cases cannot be relied on as showing anything more than that pregnancy may be prolonged for 325 or 326, less (say) 23 days. This would give 303 days, or a shorter period than in Hewitt's case. In four less certain cases of the same kind, the estimated period of gestation was 309 to 313 days (Simpson), and 314 and 324 days (Murphy).

4. In the lower animals it has been observed that the duration of pregnancy, as estimated from a single coitus, may be greatly protracted beyond the usual period.

[1] *For. Med.*, p. 123.
[2] *Med. Jur.* (1884), III. p. 41.
[3] Tessier's, Guy, *For. Med.*, p. 124.
[4] Earl Spencer's, *ibid.*
[5] Krahmer's, Wharton and Stillé, III. p. 44.
[6] Tessier's, Guy, *For. Med.*, p. 124.
[7] Krahmer's, Wharton and Stillé, III. p. 43.

On the whole, therefore, as regards the question, What is the longest period which in natural human gestation may intervene between coitus and delivery?—the form which the question under consideration assumes for forensic purposes,—it may be stated that: (1) It may be regarded as proved that this may be 296 days. (2) Most authorities agree in considering that the interval may be as long as 44 weeks, or 308 days. indeed, in the Gardner Peerage case, several eminent obstetricians gave it as their opinion that the interval might extend to, at any rate, 311 days.[1] (3) Some authorities consider that the interval may extend to the forty-sixth week, 315 to 322 days.[2]

Superfœtation.—It may be stated (1) that two closely following acts of intercourse in the same female may each prove fruitful (see case below); and (2) that it cannot be doubted but that conception may occur during pregnancy in cases where the uterus is double or bipartite, a rare condition in the human female, but still one of which several instances are recorded.

Case.—**Two closely following acts** of intercourse in the same female; both prove fruitful.—"A female at Charleston, in South Carolina, was delivered in 1714 of twins within a very short time of each other. One was black and the other white. She confessed that on a particular day, immediately after her husband had left his bed, a negro entered her room, and by threatening to murder her had connection with her."—Guy's *For. Med.*, p. 132, one of several cases quoted by Beck.

Excluding these two classes of cases, and limiting the question to whether, the organs of the female being of normal formation, it is possible for a conception of a second embryo to occur during gestation, we find that authorities are divided in opinion on the subject. The arguments for and against the possibility of conception occurring under the conditions stated are founded on (1) physiological considerations, and (2) recorded cases.

1. **Physiological considerations.**—Those who deny the possibility of the occurrence, allege that the plugging of the os uteri and Fallopian tubes, and the formation of the decidua, events which occur at a very early stage of pregnancy, offer an impassable barrier to the passage of the seminal fluid. On the other hand, those who affirm the possibility of superfœtation, deny that these conditions invariably offer an impassable barrier to the seminal fluid (especially previous to the end of the third month),[3] and point out that, as in exceptional cases menstrual blood finds its way out of the uterus during pregnancy, it is by inference also possible that seminal fluid may find its way in.

[1] In this case the question at issue was as to the legitimacy of an individual, born 311 days after the last access of the husband (see Guy, *For. Med.*, p. 125).

[2] See Ogston's *Lect. For. Med.*, p. 189.

[3] It is not until the end of the third month that the decidua reflexa, or portion of the decidua surrounding the ovum, comes into contact with the decidua vera, or portion of the decidua lining the uterus.

2. **Recorded cases.**—The cases brought forward in support of the view that superfœtation is possible, may be divided into two classes, viz.:—(*a*) Cases in which a woman is delivered at or about the same time of a more or less mature child and a less-developed dead fœtus, *e.g.* as in a reported case of a mature child and a dead fœtus of apparently five months. Many cases are, however, reported showing that a dead fœtus may be retained in the uterus until the full term of pregnancy has expired, or even for a considerable period beyond. Hence cases of this class can be explained on the supposition that conception of the two children occurred at the same time, but that one died and was retained *in utero* until the delivery of the other. Obviously, therefore, such cases do not support the view that superfœtation is possible.

(*b*) Cases in which a woman is delivered of two more or less mature children, a considerable interval, but still an interval shorter than the usual period of gestation separating the two births. Cases of this kind, where the interval between the births is comparatively short—*e.g.* in one reported case a month—are easily explained on the supposition that conception of the two children occurred at the same time, but that the delivery of one was delayed. Other cases of this description again, in which the interval between the two births is comparatively long, can be explained by supposing that conception of the second child occurred after delivery of that first born. It should, however, be noted, as bearing on this possibility, that it is highly improbable that conception can occur until a week after delivery; probably a fortnight must intervene.[1] A few cases, however, are on record in which the interval separating the births of two viable children has been four to five months, *e.g. Case* below, and a case referred to by Taylor, in which the interval was 127 days (see also *Case* below, in which the interval was 167 days, but in which no sexual intercourse took place until twenty days after the first delivery).

Supposed superfoetation.—The wife of Raymond Villard, of Lyons, eight months after a previous abortion at the seventh month, was delivered of a living female child. "This delivery was not followed by the usual symptoms, no milk appeared, the lochia were wanting, and the abdomen did not diminish in size. Three weeks after her delivery she again felt the motions of a fœtus, the abdomen increased in size, and five months and sixteen days after delivery she was again delivered of a living daughter." Both children were alive two years after the birth of the first child. "Dr. Desgranges, who attended the case, adds to his report that the second child could not have been conceived after delivery of the first, inasmuch as no sexual intercourse took place between the husband and wife until twenty days after the first delivery," or four months and twenty-seven days before the birth of the second child (Guy, p. 133).

"Marie Anne Biguad, *æt.* thirty-seven, gave birth on April 30, 1748, to a full-term mature boy, which survived its birth two and a half months, and to a second mature child (girl) on September 16, 1748, which lived one year. The interval between the two births was thus four and a half months (= one hundred and thirty-nine days). The mother, after her death, was proved not to have had a double uterus" (Tidy, *Leg. Med.*, II. p. 149, quoted from Naphey, 'Physical Life of Women,' p. 156).

Cases such as these involve the acceptance of one of three propositions, viz. either (1) That superfœtation is possible, even, as in the former case, when the uterus is not double; or (2) Supposing conception of the second child to have taken place after the birth of the first; that a viable child may

[1] Bonnar, *Edin. Med. Jour.*, Vol. X. p. 582.

be born at a very early uterine age, *e.g.* in Taylor's case at 127, or more probably 120 days; or (3) As suggested by Wharton and Stillé; that in cases of twin pregnancy the pressure of one child on the other, instead of, as is sometimes the case, causing the death of one of the two, may in exceptional cases simply retard its development; the result being that one child is born mature at the full period, and after its birth, development of the second child continues, until it also reaches maturity, when its birth takes place.

What is the earliest Viable Age?—What is the earliest period of gestation at which a child may be born alive, capable of living and being reared?—Here it may first be remarked (1) that there is no doubt but that a child born at or after the 210th day of uterine life may be reared; and (2) that the evidence afforded by recorded cases so strongly supports the view that children born as early as the 180th day may be reared, that the possibility of this cannot be denied. As regards the question of viability before the 180th day, it should be noted that the validity of the evidence afforded by cases cited to prove early viability mainly depends on the accuracy with which the date of conception is determined; for although the characters of a child at birth afford indications of its age, they cannot be relied on, except as corroborative evidence. In some of the cases cited as evidence of early viability, the date of conception is fixed from a previous delivery, *e.g.* the case mentioned by Taylor (see 'Superfœtation'), in which a viable child was born 127 days after a previous delivery, and another similar case referred to by the same author, in which the interval between the births was 174 days.[1] If we assume that in these cases conception of the second child did not take place until after the birth of the first, we must admit viability to be possible at respectively the 120th and 167th day of intra-uterine age. Obviously, however, the acceptance of cases such as these, as valid evidence of early viability, rests on the assumption that it is impossible for either superfœtation or retardation of development, as suggested by Wharton and Stillé, to occur.

Of the cases in which the date of conception is fixed independently of a previous delivery, there is one—Dr. Outrepont's case (see p. 290)—in which a viable child was born twenty-five weeks (175 days) after the last menstruation of the mother. Guy, in reference to this case, says—"It is very valuable, for it is the only quite unequivocal instance on record of the rearing of a six-months child."[2] The Jardine case (*Case*, p. 284) is a very doubtfully authentic case of the rearing of a 174-day child.

[1] Taylor, *Med. Jur.*, II. 229.
[2] Guy's *For. Med.* (4th ed.), p. 136.

There are also a few less reliable cases of the rearing of children born at a period earlier than the 174th day.[1] Among these, the earliest visible age recorded in 133 days (Dr. Rodman's case).[2] The evidence afforded by these cases, in favour of viability at a period earlier than the 174th day, is further supported by certain recorded cases, in which children born at an earlier age than this lived for some days after birth.[3]

As regards the further question, What is the earliest age at which a child may be born, capable after its birth of showing signs of life? it may be stated, that there is more than one reliable case on record, showing that a child born between the fourth and fifth month of uterine life may after birth manifest signs of life. Among these may be mentioned Dr. Barrow's case of a child born at 144 days, which after birth breathed convulsively at intervals for forty minutes.[4]

After the fourth month the uterine age of the fœtus is indicated by the following characters. (A) During life:—(1) Its length and weight; (2) changes about the eyes; (3) the appearance of the skin, nails, and scalp hair; and (4) the position of the middle point of the body. (B) After death the following additional characters become available:—(1) The progress of ossification; (2) the condition of the intestines; (3) the condition of the gall-bladder; (4) the position of the testicles; and (5) miscellaneous characters. According to Guy, Tidy, and others, these characters are as follows:—

1. **The length and weight.**—The table below gives the average length in inches, and average weight in pounds and ounces, at the end of each month.

Month.	Length.	Weight.
	in. in.	lb. oz. lb. oz.
4	4½—8½	0 3—0 7
5	6½—10½	0 5—1 1
6	8—13½	1 0—2 2
7	11—16	2 0—4 5
8	14—18	3 4—5 7
9	16—20	4 5—7 0

[1] *E.g.* Dr. Barker's case, 158 days (*Med. Times*, 1850, Vol. II. pp. 249, 392), and Capuron's doubtful case of Fortunio Liceti, 135 days (Guy's *For. Med.*, p. 129).

[2] Guy's *For. Med.*, p. 129.

[3] *E.g.* Fleischmann's case of a child of 168 days living for eight days (Guy, *For. Med.*, p. 134), and Dr. Routh's case of a child born between the fifth and sixth month living for eighteen days after its birth (*Obstet. Trans.*, 1871, p. 182).

[4] Wharton and Stillé, Vol. III. p. 51.

Exceptional cases are recorded of children at birth being unusually large and heavy. The greatest length and weight recorded appears to be 32 inches, and 18 lbs. 1 oz.; next to this comes a case where the length was 24 inches, and the weight 17 lbs. 12 oz.[1]

2. **Changes about the eyes.**—The eyelids are adherent, and the membrana pupillaris vascular and distinctly visible up to the end of the sixth month. At the end of the sixth month, the eyebrows and eyelashes are beginning to form. At the end of the seventh month, the eyelids are non-adherent, and the membrana pupillaris is beginning to lose its vascularity, and by the end of the eighth month, it is so thin and transparent as to be only with difficulty discernible.

3. **Appearance of the skin, nails, and scalp hair.**—Up to the end of the fifth month the skin is destitute of fibrous structure and sebaceous covering. At the end of the sixth month, it begins to show a fibrous structure, and papillæ begin to appear; at this period it is covered with down, and sebaceous matter begins to be visible on its surface. At the end of the seventh month, it is dusky red, thick, and fibrous, and covered with sebaceous matter. By the end of the eighth month, it is covered with fine short hairs, and the sebaceous envelope is well marked. At the end of the ninth month, the down has disappeared from the surface of the body except the shoulders. The nails begin to appear at the end of the fourth month, are very distinct at the end of the fifth month, and gradually increase in length, reaching the ends of the fingers at the end of the eighth month. Hair on the scalp begins to appear at the end of the fifth month, is about quarter of an inch long at the end of the seventh month, and at the end of the ninth month has attained a length of about an inch.

4. **The position of the middle part of the body.**—This up to the end of the fifth month lies on the body of the sternum; gradually descending, it reaches the lower end of the sternum at the end of the sixth month, is nearer the umbilicus than the sternum at the end of the eighth month, and at the end of the ninth month is generally about three-quarters of an inch above the umbilicus.

FURTHER SIGNS AVAILABLE AFTER DEATH.

1. **Ossification.**—At the end of the fourth month the ossicles of the ear are found ossified, and points of ossification have just appeared in the upper part of the sacrum (for points of ossification appearing before the end of the third month, see table on page 294). By the end of the fifth month, points of ossification have appeared, in the pubis, os calsis, axis, and odontoid process; at the end of the sixth month, in the four divisions of the sternum; at the end of the seventh month, in the astragalus; at the end of the eighth month, in the last sacral vertebra; and at the end of the ninth month, in the lower epiphysis of the femur. This last point of ossification is not present at the end of the eighth month, and great weight is attached to it by Casper and others, as a sign of maturity. According to Casper, its diameter in mature children is three-quarters of a line to four lines, and Tidy adds that if it is more than three lines in width, the child has probably survived its birth. "This

[1] Taylor, *Med. Jur.*, II. p. 314.

nucleus appears to the naked eye as a more or less circular blood-spot in the midst of milk-white cartilage."[1]

2. **Intestines.**—At the end of the fourth month, the duodenum contains meconium, the cæcum is placed near the right kidney, and the cæcal valve is visible. At the end of the fifth month meconium of a yellowish-green tint is present at the commencement of the large intestines. At the end of the sixth month in the large intestine sacculi begin to appear, and meconium is present in the upper part. At the end of the seventh month the cæcum lies in the right iliac fossa, the valvulæ conniventes begin to appear, and meconium is present nearly throughout the whole length of the large intestine. At the end of the ninth month the meconium has reached the rectum.

3. **Gall-bladder.**—The gall-bladder begins to appear at the end of the fourth month, is distinct at the end of the fifth, contains insipid serous fluid at the end of the sixth, and bile at the end of the seventh month.

4. **Position of testicles.**—At the end of the sixth month these lie close to the kidneys, and at the end of the seventh have begun to descend towards the internal ring, which they reach at the end of the eighth month. At the end of the ninth month they have, as a rule, passed through the canal and are often found in the scrotum.

5. **Other characters.**—At the end of the fifth month the germs of the permanent teeth are visible; at the end of the sixth month the cerebral hemispheres cover the cerebellum. At the end of the seventh or eighth month the cerebral convolutions are apparent.

(7) **Paternal Likeness and Disputed Paternity.**—*May paternity of a child* be inferred from its resemblance or non-resemblance to its alleged parents?—Undoubtedly peculiarities of the parents are frequently transmitted to their offspring, *e.g.* the general characters of the features, the colour of the skin, certain deformities, tendency to disease, tricks of manner, character of the voice, colour of the hair, etc., etc. Peculiarities in the parents are, however, not necessarily transmitted to their children, and, as before pointed out, a peculiarity may be subject to atavism, and miss one generation, appearing in the next. More weight, therefore, is to be attached to the presence of hereditary peculiarities as affirmative evidence than to their absence as negative evidence, of paternity. Other things being equal, the more close the resemblance, the stronger the presumption of paternity.

Recent Delivery.—*Has this woman* ever *been delivered* of a viable child?—The signs of recent delivery may be present and supply an affirmative answer—these signs will be discussed under 'Infanticide' (see p. 328). On the other hand, the signs of virginity may be present—the presence of these, especially of an intact hymen, is a strongly negative indication. An intact

[1] Tidy, *Leg. Med.*, II. p. 59 (1 line = $\frac{1}{12}$th of an inch).

External Characters of the Fœtus at the End of Each Month of Uterine Life.

Month	4	5	6	7	8	9
Average length in inches Mean weight (Guy)	6½ 5 ozs.	8½ 11 ozs.	14 2 lbs. 2 ozs.	15 3 lbs. 8 ozs.	17 4 lbs. 5 ozs.	19½ 6 lbs. 8 ozs.
Skin	No sebaceous covering or fibrous structure apparent		Fibrous structure, papillæ and sebaceous matter beginning to appear covered with down	Dusky red; thick and fibrous, and covered with sebaceous matter	Covered with fine short hairs and sebaceous matter	Down almost all disappeared; covered with sebaceous matter
Nails	Appearing	Very distinct	Growing	Do not quite reach to end of fingers	Reach to end of fingers	
Hair on scalp	None	Appearing	Distinct	About a quarter of an inch long	Over a quarter of an inch long	About one inch long
Eyes, etc.	Lids adherent; membrana pupillaris distinct		Lids adherent: membrana pupillaris distinct; eyebrows and eyelashes beginning	Lids non-adherent; membrana pupillaris getting indistinct	Membrana pupillaris hardly visible	
Position of middle point of body	On sternum	On sternum	At lower end of sternum	Below lower end of sternum	Nearer umbilicus than sternum	Just above the umbilicus

hymen may be taken as positive proof that the woman has never been delivered of a nearly mature child. Obviously, however, no conclusions can be drawn from the absence of the signs of virginity.

If the **signs** of recent delivery and virginity are both **absent,** the other chief signs to be looked for are:—

1. **Presence or absence** of the lineæ albicantes and condition of the breasts.—The presence of the lineæ and albicantes may, however, be accounted for by causes other than delivery, *e.g.* ovarian tumours, or ascites; and they may be absent in women who have been more than once delivered.[1] Enlargement of the breasts also may be the result of causes other than pregnancy.

2. **The condition of the posterior commissure.**—This, if ruptured, strongly indicates a previous delivery. If intact, the indication is strong that the woman has never been delivered of a child, and still more strong that she has never been delivered of a mature child.[2]

3. **The condition of the uterus.**—After delivery, the uterus does not wholly return to its original condition. The chief changes observable are as follows:—

(*a*) Its cavity becomes larger. According to Dr. Barnes,[3] the vertical diameter of the cavity is, in virgins 1·80, in women 2·20, and in mothers 2·44 inches; and the transverse diameter of the cavity, in virgins 0·60, in women 1·08, and in mothers 1·24 inches.

(*b*) Its walls become thicker and its weight greater. According to Dr. Barnes its weight, in girls at the age of puberty, is 360 to 1000 grains, whilst in women who have borne children its weight ranges from 1200 to 1800 grains. In advanced life, however (and in exceptional cases, in adult life after delivery), the uterus undergoes atrophy, and in old women its weight may become reduced to 100 to 200 grains.

On the whole, although the conditions of the uterus may afford strong indication of a previous delivery, no absolutely certain conclusion can be drawn from its state.

The question, "Has this woman ever been delivered of a child?" may also arise in *defamation* cases and in cases of *disputed identity.* In the trial for murder, *R.* v. *Wainwright,* cited below, this question arose with reference to the identity of the remains discovered and alleged to be those of a certain female who was missing. From the opinion expressed by Dr. Meadows in this case, it would appear that, in the

[1] Taylor, *Med. Jur.*, II. p. 162. [2] Tidy, *Leg. Med.*, II. p. 138.
[3] *Dis. of Women*, p. 32.

absence both of the signs of recent delivery, and of those of virginity, no certain answer can be given to this question.[1]

Case.—**Signs of previous delivery in exhumed corpse.**—The prisoner was tried for the murder of a woman with whom he had cohabited, and who had two children by him, the last being born about nine months previous to the time of her supposed murder. A year after her disappearance the mutilated remains of a female were discovered buried in premises belonging to the prisoner. Examination of these showed the uterus to be enlarged and flaccid; its walls were unusually thin. There were one or two white lines in the skin of the lower part of the abdomen, and other marks of a darker colour in the inguinal region. Two medical men who had examined the remains were of opinion that they were those of a woman who had borne a child. Dr. Alfred Meadows, called for the defence, was of the contrary opinion, but stated that he believed it to be impossible to decide this question in any case with certainty.—*R.* v. *Wainwright.*

[1] Taylor's *Manual*, p. 496.

CHAPTER XIV.

RAPE.

(See also Chap. XI. on 'Virginity and Defloration.')

The crime of rape is a felony punishable by imprisonment up to penal servitude for life; and formerly it was punished by castration and death. As it is usually committed in the absence of witnesses the law admits the testimony of the alleged victim, but the medical evidence is essential, as a large proportion of the accusations are false charges.

Definition of Rape.—According to the law of India (*I. P. C.*, *s.* 375, and also according to that of England[1]), rape, subject to certain explanations detailed below, may be defined as sexual intercourse by a man with—(1) any female (including his own wife) under the age, in India, of twelve[2] (in England it is thirteen), or (2) any female over the above-stated age, not being the man's own wife—(*a*) against her will, or (*b*) without her free consent, or (*c*) even with her consent, when this has been obtained in certain unlawful ways. The explanations above referred to are:—

Degree of penetration necessary to constitute 'Rape.'—In India, the rule on this point is laid down in the explanation attached to *s.* 375 of the Penal Code as follows:—"*Penetration is sufficient to constitute the sexual intercourse necessary to the offence of rape*," and in the case of *Reg.* v. *Ferroll* (Bombay High Court Sessions, February, 1879), Green, J., directed the jury that *vulval penetration only* was sufficient, under the law of India, to constitute rape (see *Case* below) without actual seminal emission. In this case the prisoner was charged with rape on a child six years old. The child had not complained, and admitted on cross-examination that she had not been hurt. The medical evidence proved there was no injury to the parts. The child was found to be suffering from gonorrhœa, so was the prisoner. It was clear that the penetration (if any) had been only vulval. Green, J., directed the jury that this was sufficient to constitute rape, and the prisoner was convicted of rape.—*Reg.* v. *Ferroll*, Bombay High Court Sessions, February, 1879.

[1] *Criminal Law Amendment Act*, 1885 (48 & 49 Vict. c. 69, *s.* 4).
[2] Act X. of 1891, *s.* 1.

Age of the Male accused.—As already pointed out, it is an irrebuttable presumption of English law that a boy under the age of fourteen is incapable of committing rape. In England, therefore, a boy under the age of fourteen cannot be convicted of this offence. The criminal law of India contains no special presumption as to the age at which a boy attains potency, and becomes capable of committing rape. It, however, contains two general exceptions bearing on the question of age in regard to criminal responsibility, and applying to rape as to other offences. These exceptions are in effect (1) that a child under the age of seven cannot be held criminally responsible for his acts, and (2) that a child between the ages of seven and twelve can only be held criminally responsible for his acts if he has attained a certain specified degree of maturity of understanding (*I. P. C.* 82, 83). Hence, in India, if the case of a boy charged with rape does not fall within one or other of these general exceptions, the question of the capacity of the accused to commit the offence is left to the court to decide according to the evidence produced in the case. Thus, "in the case, *Kureem Noorbae* v. *Meun Noorbae* (2 *N. A. Rep.*, p. 87), a boy of ten years was convicted for rape by the Court of Sessions, but the Nizamut Adawlut, considering it unadvisable to admit his capability, viewed the matter only as an attempt."—O'Kinealy's *Penal Code*, p. 177.

Age of consent in Female.—In Indian law sexual intercourse with a female of or over the age of twelve, with her valid consent, is not an offence, but see p. 42. According to the law of England, however, sexual intercourse with a female of or over the age of thirteen, but under that of sixteen,[1] with her consent, is (unless it be proved that the accused had reasonable cause to believe that the girl was of or above the age of sixteen) a misdemeanour punishable less severely than rape.[2] Marriage is no defence in this case, notwithstanding that the marriageable age for a female in England is twelve years of age, and the fact that the girl forgives the accused or subsequently enters into the marriage relations with him, does not relieve him technically from the crime, as the law holds that the female being under the age of consent, her consent as to the sexual act constitutes no defence, though such forgiveness by her for her injury and acceptable amends usually terminate the prosecution.

Consent of the Female is invalid under the following circumstances:—In Indian law consent of a female to sexual intercourse is not valid, and does not exculpate the accused, if the manner in which it has been obtained falls within (*a*) certain general exceptions of the Penal Code in regard to consent (see *s.* 90); or (*b*) certain special exceptions in regard to consent to sexual intercourse embodied in *s.* 375 of the *Code*, namely:—(1) If it is given *under misconception of fact*, and the man knows, or has reason to believe, it was so given (*s.* 90). (2) If the woman by reason of *unsoundness of mind, or intoxication*, is unable to understand the nature and consequence of the act to which she consents (*ibid.*). (3) If her consent has been obtained by putting her in *fear of death or hurt* (*s.* 375). (4) When the man *impersonates her husband*, and her consent is given because she believes that he is another man to whom she is, or believes herself to be, lawfully married (*s.* 375). Regarding these exceptions it may be noted:—(1) That, as regards exception 1, a female, for her consent to be valid, must be aware that the act to which she consents is sexual intercourse. On this point the law of England

[1] Confer p. 42. By *Criminal Law Amendment Act*, 1885, *s.* 5, imprisonment with or without hard labour not exceeding two years may be imposed.

[2] In the United States of America the age of consent is 18.

agrees with that of India (see *Case*, below). (2) That, as regards exception 2, the law of England appears to differ somewhat from that of India, it having been decided in the case of *R.* v. *Fletcher*,[1] in which a man was charged with rape on an idiot, that "a consent resulting from a mere animal instinct would suffice to prevent the act from constituting a rape." By *s.* 5 of 48 & 49 Vict. c. 69, however, sexual intercourse with "any female idiot, or imbecile woman or girl, under circumstances which do not amount to rape, but which prove that the offender knew, at the time of the commission of the offence, that the woman or girl was an idiot or imbecile," is a misdemeanour punishable less severely than rape. (3) That the law of England agrees with that of India in regard to exception 3. (4) That, as regards exception 4, it was ruled in *R.* v. *Barrow* (L. R. 1 C. C. R., p. 156), that this is not rape by English law. Since then, however, it has been enacted that a man who "induces a married woman to permit him to have connection with her by personating her husband" is guilty of rape (*Criminal Law Amendment Act*, 48 & 49 Vict. c. 69, *s.* 4).

Case.—**Conviction for rape** where consent was given under misconception of fact. From Tidy's *Leg. Med.*, II. p. 244; *R.* v. *Hattery*, L. R. 2 Q. B. D., p. 140.—"The prisoner, a quack-doctor, professed to give medical and surgical advice for money. The prosecutrix, a girl of nineteen, consulted him with respect to an illness from which she was suffering. He advised that a surgical operation should be performed, and under the pretence of performing it had carnal connection with the prosecutrix. She submitted to what was done, not with any intention that he would have carnal connection with her, but under the belief that he was merely treating her medically, and performing a surgical operation, that belief being wilfully and fraudulently induced by the prisoner. The Court were unanimously of opinion that these facts constituted the crime of rape."

Cases of females compelling young boys to have intercourse with them are recorded by Chevers and Powell as having occurred in India, in which young boys had, under compulsion, intercourse with their *ayahs* or other females. Cases of this description, however, do not come under the definition of 'rape' laid down in the Indian Penal Code.

Under the penal code of France, it is an offence for a woman to attempt sexual intercourse, with or without consent, with a boy under the age of eleven.

Age of Victim.—Young children are more frequently raped than adult women, as they are less capable of offering resistance, and as in India the practice of infant marriage creates a desire for intercourse with immature girls. Besides an occasional motive for the rape is the old-world superstition, common both to India and Europe, that intercourse with a virgin is a cure for venereal disease, and the younger the girl the greater the probability of her being a virgin. The child-wives of India are still, to a large extent, the victims of rape

[1] L. R., 1 C. C. R., p. 39; Tidy, *Leg. Med.*, II. p. 194.

at the instance of their maturer husbands, notwithstanding the Act of 1891, which raised the nubile age from ten to twelve years. For there is reason to believe that premenstrual congress with children is still largely practised in this country under the cover of marriage.

The age: in 205 cases of proved rape in Bengal during the three years 1871–73 there was one 2 years old, one $2\frac{1}{2}$, one 3, three 4, five 5, nine 6, nine 7, eighteen 8, twenty-one 9, twenty-six 10, nineteen 11, twenty 12, thirty between 12 and 15, and only nineteen above 15. That is to say, 51 per cent. were under 10 and 89 per cent. under 15 years of age. In the year 1868 of 48 cases in Bengal in two the age was 5, in seventeen between 6 and 10, in ten between 11 and 15, in seven between 16 and 20, in three above 20, and in nine not stated—that is to say, about half of the victims were under 10 years of age, and in most of the cases the children were badly hurt.

Questions in Rape Cases.

1. **Can a man unaided** commit a rape on an adult female of ordinary strength, in full possession of her senses?—It has been alleged that this is impossible. That, however, in exceptional cases, rape may be committed under the circumstances stated, is shown by the case below, reported by Casper, who, in regard to it, remarks: "The interest of this important case cannot be mistaken, for it shows that a healthy, powerful woman was certainly completely violated by a single man."[1] Ogston also, in reference to this question, remarks that the arguments advanced against the possibility of intercourse under the circumstances stated, "apply rather to the case of entire penetration of the vulva, than to the partial entry, which is now admitted in law as amounting to the crime of rape. That such entry may be forced in an ordinary case, I had the assurance of actual fact in at least one serious case."[2] Chevers, again, gives two cases in which rape was effected by unaided single men on adult females. Of course, the younger and weaker the female, and the stronger the man, the greater the probability of the commission of the offence being possible; *Case* p. 301 illustrates this. A very old woman also may be incapable of offering sufficient resistance. Chevers mentions a case in which a man committed a rape on a woman of seventy.

Case.—**Rape by one man unaided** on an adult female (from Casper's *Handbook*, Vol. III. p. 311).—"L. persuaded F., a girl aged twenty-five, to accompany him to the Tiergarten in the dark, and after he had been baulked by her struggles in his endeavours to violate her against a tree, he seized her round the body and flung her on the ground, and being now, as she states, deprived of the power of resistance, he flung her dress over her head and violated her. Nine days subsequently I had to

[1] Casper, III. p. 311.

[2] *Lect. Med. Jur.*, p. 120.

examine her. She was deeply moved by what had befallen her. The entrance to the vagina was still reddened, and painful when touched and dilated; the hymen was completely torn, and bright red; carunculæ, still slightly swollen, were visible; the frænulum still existed. Without any leading question, and only in answer to general queries as to her bodily and mental condition, she declared that still a little, and several days ago much more, she could only with difficulty walk and pass urine and fæces. After carefully considering all that required to be considered in such a case, I came to the conclusion that a rape had actually been committed upon F. At the time of the trial, circumstances came out which only served to confirm this opinion. The police-officers who had hurried up at the cries of F. testified that the ground upon which she had been thrown was hard frozen, and they deposed that L., when arrested, and after his lust had been satisfied, was still in a condition of actual satyriasis."

Case.—**Rape by one man unaided** on a married girl *æt.* sixteen.—Fadil Gazee, of Jessore, a tall and powerful man, seeing a married girl of sixteen standing at her door, accosted her, apparently under the pretence of asking for a *soot nullee*, and wished to worm out of her if she was alone; finding that she was, he put his arms round her, forcibly drew her into the house, flung her down, and, gagging her mouth with her right hand, effected a criminal connection with her. Before her mouth was well gagged she managed to yell out for assistance, and her cries brought her mother and a neighbour, who found him in the act. He then got up hastily, offered to give her a rupee if she would say nothing more of the matter, and ran off.—Chevers, *Med. Jur.*, p. 702.

2. **Can a woman during sleep be violated** without her knowledge?—A woman can undoubtedly be violated without her knowledge while **under the influence of narcotics** (anæsthetics, also alcohol), or during syncope or coma; and it has been alleged, with reasonable possibility, during **mesmeric trance** (see *Case* below). It is probable also that, in exceptional cases, a woman accustomed to sexual intercourse may be violated during profound natural sleep. Guy, in support of this view, mentions the case of a woman who, in illustration of a symptom which somewhat alarmed her—viz. that her sleep was unnaturally heavy—told him that her husband had assured her that he had frequently had connection with her during sleep.[1] On the other hand, it is highly improbable that a virgin could, during natural sleep, be violated without her knowledge, or even that, without her knowledge, sexual intercourse sufficient to constitute rape could be effected with her. Cases are reported where it is alleged that this has occurred (see *Cases* below); but it may be: "Non omnes dormiunt qui clausos habent oculos!"

Case.—**Alleged violation during mesmeric trance.**—"A girl (*æt.* eighteen) consulted a therapeutic magnetizer as to her health. She visited him daily for some days. Four and a half months afterwards she discovered that she was pregnant, and made a complaint to the authorities

[1] *For. Med.*, 4th ed., p. 57.

against the magnetizer. They directed a physician and surgeon to determine the date of her pregnancy, and whether complainant might have then been violated and rendered pregnant contrary to her will, *i.e.* if her volition could have been completely or partially annihilated by magnetism. The medical inspectors were satisfied that the pregnancy did not extend further back than four and a half months; and founding their opinion on M. Husson's report, made to the Academy in 1831, concluded that, as a person in magnetic sleep is insensible to every kind of torture, sexual intercourse might then take place with a young woman without the participation of her will, and without her being conscious of the act, and consequently without her being able to resist the act consummated on her. This opinion was confirmed by that of Devergie (*Gazette Médicale de Paris*, and *Edin. Month. Jour.*, December, 1860, p. 566).

Case.—**Alleged violation** during profound natural sleep.—A servant woman at an hotel in Nenagh proved pregnant, and solemnly declared that she was not conscious of having had intercourse with any man. Suspicion, however, fell upon an ostler in the establishment, who subsequently acknowledged that he believed he was the father of the child; that, having found the woman in a deep sleep from fatigue, caused by long-continued exertion and being kept out of bed two or three nights in succession, he had connection with her, and, as he believed, totally without her knowledge, as she did not evince the slightest consciousness of the act at the time, or recollection of its occurrence afterwards. The parties were married with mutual consent.—Ogston, *Med. Jur. Lect.*, p. 121.

Case.—**Another case.**—Casper met with a solitary case in which a girl, *æt.* sixteen, accused a man of having had intercourse with her while she was sleeping in her bed, of which she was not conscious, until he was in the act of withdrawing from her. On her own statement she was *virgo intacta* up to the date of this occurrence. Upon the facts of the case Casper came to the conclusion that, if her statement was true, the man could not have had intercourse with her without causing pain and rousing her to a consciousness of her position. The hymen was not destroyed, but presented lacerations in two places. This and other facts showed that there had been intercourse, but this did not prove that this had taken place without the consciousness of the woman.—Taylor, *Med. Jur.*, II. p. 445.

3. **May pregnancy follow rape?**—It was formerly alleged that pregnancy never followed rape, and that hence if a woman charged a man with committing a rape upon her, and became pregnant as a result thereof, the charge must be untrue, and the woman must have consented to the intercourse. Impregnation is, however, independent of volition on the part of the female, and hence pregnancy, as is proved by more than one recorded case, may undoubtedly follow rape.

4. **May rape cause death?**—The introduction of the mature male organ into the vagina of an immature female may produce local injury sufficient to cause death from hæmorrhage, shock, or subsequent inflammation, such as peritonitis or gangrene, by violent laceration of vagina or perinæum. Such a cause of death was not uncommon amongst the child-wives in

Bengal up till at least 1890, when a notorious case (see below) attracted medical notice, and led to the Act raising the nubile age from ten to twelve. Even now cases of this kind doubtless happen not unfrequently and are concealed, the death being attributed to other causes. Chevers mentions 14 cases of death from this cause; and Harvey[1] records that in Bengal, in the three years ending 1873, out of the 205 cases of rape which were proved, in 24 of these laceration of the vagina, generally of the posterior wall, was found; and in 14 the perinæum was torn, the rent varying from one-fifth of an inch to one inch in length. Five of these cases terminated fatally (see also *Case* below). Injury to the genitals of a young female may, however, be caused in order to support a false charge (see *Case*, p. 309). Violent sexual intercourse in a young female at or near the age of puberty, may cause constitutional disturbance, leading to fatal hæmorrhage into the brain, peritoneal cavity, etc. On the question whether death may result from nervous exhaustion, the result of repeated intercourse, Chevers cites the case of certain Marquesan women, who boasted, apparently with truth, of having had intercourse with one hundred men in one night. The intercourse, however, was voluntary; had it been otherwise, no doubt the exhaustion would have been greater.

Case.—**Rupture of Vagina** in girl-wife by sexual intercourse.—In 1890 at the Calcutta High Court a fully developed Bengali, aged 35, was charged with causing the death as above of his child-wife, a girl aged 11 years and 3½ months. Medical evidence testified that the girl, although well developed for her age, was immature, had not attained puberty, and was wholly unfit for sexual intercourse. The injury inflicted was a rent of the vaginal wall on the right side of the *os uteri*, measuring 1¾ inch in length and 1 inch in breadth. Copious hæmorrhage took place immediately after intercourse. The girl died of exhaustion 13½ hours after the act. The vagina was found to be distended with a clot measuring 3 inches in length by 1½ inch in breadth, and there was a globular hæmatoma in the right broad ligament, measuring 3 inches in diameter. The mucous surfaces and internal organs were exsanguine; the uterus was infantile, and ovaries showed no sign of active ovulation. There was no sign of injury of the labia or vulva, and no trace of hymen. These circumstances were held to indicate that sexual intercourse, more or less complete, had taken place on previous occasions. The wall of the vagina was thin and showed no *rugæ*. The evidence in this case clearly established the fact that the fatal injury was caused by the sexual intercourse of this mature male with an immature female, his wife. The court held that when a girl is a wife and above the age of consent (which at that time was only ten years), although it is therefore not rape, still the husband has not the absolute right to enjoy the person of his wife without regard to her safety. Found that the prisoner caused the death of the girl by a rash and negligent act.—*Queen Empress* v. *Hurry Mohun Mythee*, I. L. R., 18 Cal. 49; J. Wilson, July, 1890.

[1] *Bengal Med. Leg. Rep.*, 1870–72, pp. 179 *et seq.*

Case.—**Death following rape.**—Rape on a female *æt.* nine. Death from hæmorrhage from a wound on the genitals ascribed to the introduction of the male organ. The left wall of the vagina was ruptured from the orifice upwards for 2½ inches, and the rent was an inch wide.—*Ind. Med. Gaz.*, November, 1875.

On the other hand, it has been held to be physically impossible that a girl of tender age should be killed by any violence in rape, and not show external signs of violence (*Queen* v. *Banee M. Mookerjee*, 1 W. R. 29, November 22, 1864).

Rape on the dead.—It is necessary to find in such cases whether the female died from assault combined with rape, or was violated afterwards. The direction of the flow of blood will give indications. In cases of young children it is probable that rape was first committed and murder afterwards. In older females it is probable that they were murdered first and violated afterwards.

Cases.—**Rape on Dead.**—(*a*) *R.* v. *Kerr.* Charged with rape on woman whose death was not from injuries produced, but from suffocation by vomited matter entering larynx by the violence offered. Locally there were two lacerations in vagina in addition to excoriation of abdomen and blood on the external genitals. The most conclusive *circumstantial evidence was the knees of the prisoner's trousers* were soiled with mud corresponding to that of the place where the assault was committed, and adherent to them was some red-coloured woollen fibre resembling that of the fabric of the woman's petticoat. Although prisoner averred that the woman consented he was found guilty.—Carlisle Summer Assizes, 1889.

(*b*) **St. Ayr Case.**—Female killed first and raped afterwards.—Sir Jas. Stephens, *Crim. Law of England*, 345 f.

(*c*) **Léotade Case.**—The body of the girl bore marks of a violent attempt at rape which was unsuccessful because the girl was not mature. In addition was violence to her head by a broad, blunt instrument.—*Id.*, 318 f.

(*d*) **Rape with Murder.**—A lad of Benares, who stated himself to be eighteen, but who appeared to be fourteen or fifteen years old, confessed at the *thannah* and magistrate's court that he had carnal knowledge of a child of seven, had caused her death in so doing, and had stolen her ornaments. The body was found concealed in a room, much decomposed, with a stone on the chest, and a cloth wrapped round the neck. Dr. Leckie, on removing the cloth, found that the whole of the soft parts of the neck had been destroyed, from which he inferred that it had been compressed, and that strangulation was the probable cause of the death. —*Niz. Ad. Reports, N. W. P.*, June, 1853.

EXAMINATION IN RAPE CASES.

As neither the complainant nor accused can be compelled by a magistrate or any one else to submit to being examined

(without being guilty of and running the risk of a charge for indecent assault), the medical man must invariably, and in the presence of witnesses, obtain the *consent* of the person in question to make his examination, and at the same time caution the persons that the results of the examination may be used as evidence against them. Where the victim is under age, the consent of the nearest guardian should be asked. If a woman refuses to be examined it is probable that no rape has been committed.

The examination will comprise: (1) Examination of the victim or complainant, (2) The accused, and (3) Stained linen worn by the parties at the time, and (4) The spot where alleged crime was committed.

Examination of the Victim.

Having obtained her consent, and in the presence of a third person in order to avoid false charges being brought against you, commence in a good light, to make your examination; after note down in writing the following points [1]:—

Preliminary Examination:—

1. Date and exact hour at which she visits you.	1. With reference to lapse of time since alleged rape. If long delayed, why? as traces may disappear in 3 or 4 days.
2. Her walk and mental state.	2. Referring to pain, emotional state, alcohol, etc.
3. Who accompanies her, and their attitude towards accused.	3. Referring to concocted tales.
4. Her statements.	
(1) Age.	
(2) Date, time and place of alleged offence.	
(3) Exact position of parties, sitting, standing, etc.	
(4) Did she cry out or struggle?	4. Screaming out does not necessarily imply want of consent when it is done only when discovered by a third party in a compromising position.
(5) Was she sensible the whole time?	
(6) Menstruating or not.	

Examination of her clothes.—Then let her be undressed, in such sections as are required, by some other person, and note if stains of blood, semen, mud, etc., are on her clothes. The clothes may be found torn or stained with blood, and

[1] Modified after F. T. Smith, *Med. Jur.*, 192.

marks of blood may be found on the person. Of course, in such a case, the question will arise whether the blood is menstrual or not. As already pointed out, stains of menstrual blood cannot be distinguished from stains of other blood; by inquiry, however, it will have been ascertained whether or not the female was menstruating at the time of the alleged commission of the offence. If the female is seen soon after the alleged rape, the discharge from the vagina, if a discharge exists, or the vaginal mucus, should be examined for the presence of spermatozoa (see below). Spermatozoa may even be found in the vaginal mucus ten to fourteen days after rape. Stains containing spermatozoa may be found on the clothes; but it must always be recollected that the non-discovery of spermatozoa does not prove the absence of semen.

Seminal Stains.

The examination for seminal stains is made in connection with cases of rape and unnatural crime, though in neither of these is the detection of semen essential to the proving of the crime, for the actual emission of semen is not necessary for legal conviction.

Characters of the seminal stain:—(1) Semen stiffens cloth like starch, and is of a light greyish-yellow colour; pus and several other discharges stiffen cloth in a somewhat similar manner. (2) The characteristic odour may be given out on moistening the stain, if the cloth is otherwise sufficiently clean. (3) Presence of spermatozoa. This is the only positive and trustworthy test for semen, but it is essential that one or more should be seen in a complete form, with filament attached.

Mode of examination.—If taken direct from the vaginal mucus, a drop of the latter is placed on a slide and covered with a thin cover-glass and examined with a power of 300 to 400 diameters. If dried, as upon a garment or hair, the examination is more difficult, see below, also Hankin's method in Appendix IX., which is specially adapted for tropical conditions.

If the semen has dried on a fabric or on hair (the part of female underclothing most likely to contain semen are the back and front of inner garment over the genitals), the spermatozoa require to be softened and carefully separated without breaking from the material to which they have been glued down by the drying of their albuminous fluid. For this, the stain should be handled as little as possible and kept flat during the softening. A weak solution of hydrochloric acid, one drop to 44 c.c. (as recommended by Ungar), is the best softening solution to

avoid undue swelling. A few drops of this solution is put into a watch-glass with a fragment of the stained cloth, which latter is so placed that its lower end dips into the fluid and is allowed to soak for a few minutes to several hours, according to the age of the stain. When the softening is complete, the fragment of cloth is removed by forceps and gently dabbed on the slide to shake out the spermatozoa, the mark or deposit thus obtained is covered with a cover-glass and examined microscopically. As the spermatozoa are very translucent they may be made more apparent by being stained. The simplest way of doing this is in the moist way, combining the staining and softening solutions in one. A solution of methyl green 0·15 to 0·3 grain in 100 c.c. of water to which 3 to 6 drops of hydrochloric acid is added, is to be used as above described, but the fabric must steep in it for several hours. By the dry method double staining of the deposit may be made by eosin and logwood (Friedänder's) or by eosin and methyl green, whereby at the base of the head of the spermatozoon is a hemispherical portion which stains green while the anterior part and tail stain red.

Characters of Spermatozoa.—These are minute bodies with an oval or pear-shaped transparent head (which strongly refracts light posteriorly) and a long slender tail. Human spermatozoa have a flattened, almost oval head, and vary in length from $\frac{1}{1000}$ to $\frac{1}{500}$ of an inch, the head being about $\frac{1}{9000}$ of an inch in diameter (see *Plate IV.*, Fig. *a*). It is not easy to recover spermatozoa from stains on cloth even from spots of undoubted semen. Careful search should be made in several specimens of the deposit. For sometimes the seminal fluid contains numerous spermatozoa, at other times only a few, and frequently they are at times absent from the seminal fluid, even of young healthy men. Hence, while the discovery of spermatozoa in a stain is positive evidence of its seminal origin, their non-discovery does not enable you to swear that the stain is not semen. When a seminal stain is mixed with much blood or the clothes are very dirty, the detection of semen is especially difficult. Monad animalcules and threads of fibrin or broken pus nuclei in the stain-preparations must not be mistaken for spermatozoa.

Characters of Vaginal Monad Animalcules.

Powell has found Trichomonas vaginalis in about one-third of the rape cases brought for medico-legal examination, when there is sufficient vaginal secretion to make a moist cover-glass preparation. He has kindly contributed the following important note of his methods.

"The animal is pear-shaped (see Fig. 2, *Plate IV.*), about two to three times the diameter of a red blood-corpuscle (16 to 20μ). Its power of locomotion under a cover-glass is small, but its rotatory movement and the lashing of its flagella are so active that it is extremely difficult to count the latter. If the light from the condenser be partially shut off the presence of the animal is readily detected by the commotion of the neighbouring pus-cells caused by the lashing flagella. At the pointed end of the pear-shaped body is a short, stiff rod. At the opposite end are three flagella, sometimes a flagellum trails backward along the edge of the undulant membrane. *There are no cilia as described by*

Donné and figured in Taylor's, Dixon Mann's and other text-books. Sometimes a small notch or a kink in the undulant membrane may be seen close to the flagella. In this notch or mouth a particle of dirt or debris may lodge and give rise to the impression of cilia. The body is granular, of the same colour as the pus-cells, possesses a nucleus and sometimes a vacuale-like spot. Though fairly expert in the technique of fixing and staining Flagellates, I have never succeeded in staining one of these parasites. In a few cases I have found in the vagina a smaller monad 7–10μ in diameter with only two flagella. The size of these monads, their granular appearance, the number of their flagella, the difficulty in staining, and the fact that they break up and are unrecognizable in dry smears must prevent any one mistaking them for spermatozoa."

Examination of her person.—Note her physical development, with reference to power of struggling, etc., and any bruises or scratches with reference to possibility of self-infliction.

Scratches, finger-marks, bruises, or wounds, may be found on parts of the body other than the genitals, and the more the resistance offered the more likely are such marks to be found. Hence, therefore, such marks are likely to be more numerous if the subject is an adult female, and less numerous if a child. Even, however, in the case of an adult female, a rape may have been committed, and no such marks may be found. This may happen if the offence was committed while the female was insensible, or if several persons combined in the assault, some holding the female; or even where one man only has been concerned in committing the offence, when the woman has been nearly suffocated by her clothes being thrown over her head. Marks of violence employed to prevent the female crying out, may be found on the mouth or throat.

Sometimes violence employed for this purpose results in death from suffocation. Thus Chevers mentions a case where the husband of a young girl, in order to stifle her cries during first connection, bound a cloth over her mouth, and after intercourse found her to be dead.[1] In a case which came before the Bombay Chemical Analyzer's office, it was reported that "deceased had been violated before death, and that the cause of death was suffocation, produced by the forcible introduction of earth into the mouth and windpipe.[2]

Then examine the genitalia for signs of loss of virginity and other injury or disease; noticing first the hairs on pubes, whether matted or stained, cutting off a portion of any such for microscopic examination; also whether any bruising, redness, or swelling of the *vulva* and any discharge from the *vagina.*

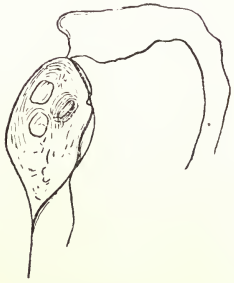
1. **Signs of loss of virginity.**—These are obviously only available as evidence of rape in cases where the female was *virgo intacta* previous to the commission of the offence. The hymen: as this is the most reliable sign of virginity, so rupture or laceration of this membrane is the chief sign of defloration

[1] *Med. Jur.*, p. 695. [2] Tidy, *Leg. Med.*, II. p. 200.

a

HUMAN SPERMATOZOA × 900.

b



TRICHOMONAS VAGINALIS (Donné).

(Drawn from life by Prof. A. Powell.)

Scale |———————| = 16—22 *m*

[*To face p.* 308.

available as evidence of rape, the various other signs of virginity being, as a rule, not lost as a consequence of one intercourse. Recent lacerations of the hymen are "sharp-edged, fresh-looking, and tender"[1]; and when rupture of the hymen has recently occurred, the carunculæ myrtiformes are found swollen and tender; also in recent defloration, especially if due to rape, a hot and tender condition of the genitals, accompanied by pain in walking, and pain and difficulty in passing urine and fæces, perhaps lasting some days, may be present. There may or may not be laceration of the fourchette.

Laceration or rupture of the hymen may, however, occur independently of sexual intercourse, viz. from the introduction of foreign bodies other than the penis. Rape, again, even in females over the age of puberty, may be unaccompanied by injury to the hymen; and, as already pointed out, in very young children the hymen is not usually even lacerated by sexual intercourse. On the whole, therefore, the presence of signs of recent injury to the hymen is to a certain extent evidence, but by no means conclusive evidence, in support of a charge of rape. The evidence, however, in favour of rape becomes stronger in proportion as the signs of local and other injury are greater. On the other hand, especially in young children, the absence of injury to the hymen cannot be taken as negativing the supposition that rape has been committed.

2. **Other injury to the genitals.**—Rape by an adult on an immature female usually causes a considerable amount of local injury. The injury may amount simply to bruising, but frequently laceration of the parts results, and these lacerations may be extensive and severe enough to cause death. Severe injuries may be followed by inflammation and sloughing of the parts. Again, injuries to the genitals of immature females resembling those resulting from rape, have been caused by the introduction of foreign bodies other than the penis with the object of rendering them *aptæ viris*, or in order to support false charges (see *Case* below).

Case.—**Injury to the genitals** of a young girl for the purpose of supporting a false accusation.—A procuress brought a girl into the officers' barrack, Fort William, Calcutta, but the person to whom she was presented objected to the girl on account of her youth. The bawd, having been disappointed of her fee, injured the girl so as to cause very considerable hæmorrhage from the genital organs. The girl was seen by an assistant-surgeon in the fort, and the circumstances of the case having been reported to the police, it was discovered to be a conspiracy against the officer to obtain money. The child recovered.—Chevers, *Med. Jur.*, p. 701, from the *Med. Times and Gaz.*, May 21, 1859.

[1] Tidy, *Leg. Med.*, p. 200.

In females who have reached puberty, laceration of the genitals may be found, if the disproportion between the size of the organs of the parties is great, or if much violence has been used. In adult females accustomed to sexual intercourse, lacerations are not likely to result from rape alone. Cases, however, are reported, where fatal laceration of the genitals has been produced in adult females after violation, by forcing foreign bodies such as sticks into the vagina. Bruises, scratches, and marks of violence, other than those caused by the introduction of the penis, may be found on the genitals, especially in adult females, but may be absent. On the whole, the presence of marks of local injury to the genitals is, to a certain extent, evidence in support of the supposition that rape has been committed. On the other hand—except when the subject is an adult female accustomed to sexual intercourse—the absence of such marks is strong, but not conclusive evidence against the same supposition.

Case.—**Post-mortem appearance of** *noma pudendi* in a girl aged five. —"The genital organs externally, and the skin around and beyond the anus, were intensely inflamed, swollen and ulcerated, and in an approaching state of gangrene or sloughing. The hymen was destroyed posteriorly, and the lining membrane of the vagina and uterus was much inflamed, of a dark purple colour, with softening and disorganization of substance. The upper inguinal glands were enlarged on both sides. The child was in a neglected and dirty state."—Taylor, *Med. Jur.*, II. p. 432.

3. **Signs of infection with disease.**—Many cases of rape by adults on young children owe their origin to a popular belief that sexual connection with a virgin is a cure for venereal disease; and there is no doubt that in this way female children are infected with gonorrhœa, a disease readily communicable to them. Ogston[1] mentions the case of a man who, while affected with gonorrhœa, had connection with four female children, communicating the disease to three of them. Female children, however, may become infected with gonorrhœa without intercourse. A case is recorded in which two girls, *æt.* respectively one and four years, became infected with the disease from using a sponge which had been used by a female suffering from it.[2] It is, however, not easy to distinguish non-syphilitic from syphilitic sores; or a gonorrhœal discharge from a muco-purulent discharge, arising from worms, etc., in dirty or delicate children, but it can be so distinguished (see *Case* below). Adult females are liable to leucorrhœa, which although usually a mucous discharge, may become, like gonorrhœa, muco-purulent owing to ulceration of the vagina. In adult females, also, it must be noted that the existence of syphilitic sores or of

[1] *Lect. Med. Jur.*, p. 96. [2] *Med. Gaz.*, Vol. XLVII. p. 144.

gonorrhœa, only proves impure connection, not rape. The period of incubation of syphilis, or of gonorrhœa, may have an important bearing in a case of alleged rape. This in gonorrhœa varies from some hours to three or four to twelve days, and in syphilis from fourteen to forty-five or more days. Hence, if a female is seen within a few hours after an alleged rape has been committed, and is found to be suffering from a profuse discharge; or is seen within a few days, and is found to be suffering from syphilis; the presumption is strongly against the disease having been communicated during the intercourse represented as a rape. It should further be noted that infected individuals do not necessarily by intercourse communicate either gonorrhœa or syphilis.

Case.—**False charge of Rape.**—"S., girl of 18, charged three hackney drivers with raping her the previous night. She professed to have been a virgin up to the time of the alleged rape. On examination, I found a profuse and chronic gonorrhœa. The hymen was represented by mere caruncles. None of the three accused then or a week later had any sign of gonorrhœa."—Prof. Powell's *Reports*, 1917.

Cases.—Dr. Powell cites a case (*Ind. Med. Gaz.*, 1902, p. 232) where he knew four men to have connection with a woman suffering from a copious gonorrhœal discharge, and only one was infected, and in another case out of seven troopers only two of them were infected. Mr. Hutchinson estimates that probably not once in a hundred acts of coition with a syphilitic partner is a chancre contracted.

In the case of rape on young children, however, there is greater likelihood of inoculation on the freshly torn surface.

The discharge should be examined microscopically with the requisite stains for the detection of the gonococcus of Neisser.[1]

If the accused be suffering from gonorrhœa, the vagina of the complainant should certainly be searched for spermatozoa and gonorrhœal pus as soon as possible. Here, as recommended by Dr. A. Powell, a douche should be given, and a second examination for pus and gonococci made an hour or two later. If gonococci be now abundant, on the day of the alleged rape, they cannot be due to that act. A third examination should be made at the end of a week. If gonococci or the soft sore be now present, and had existed on the prisoner at the time of the rape, the evidence will be of value.

When examining for gonococci it is well to take two slides. One is stained with methyl blue, the other with aniline violet, and examined in xylol under a cover-glass. If preferred the Gram stained slide may at once be counter-stained with Bismarck Brown, in which case the gonococci will be brown. The position of some diplococci is then noted and marked with a finder, Gram's process is then completed. If the cocci be gonococci they will be decolorized. The civil surgeon in India is not

[1] Doubts have been expressed as to the pathognomic value of the gonococcus. Thus, Morrow (Genito-Urinary Diseases) adduces the cases of six raped girls in which a pseudo gonococcus or diplococcus was found, which was morphologically and bacteriologically identical with the gonococcus of Neisser, but none of them suffered from gonorrhœa.

likely to have serum culture material at hand, but he may inoculate agar tubes. Should diplococci develop, they cannot be gonococci. In the intertrigo of children, due to dirt, the staphylococci, albus, and aureus are most commonly found. In discharges from the vagina, bacilli of the colon type are common.[1]

Case.—**Gonorrhoeal infection in Sodomy.**—Dr. A. Powell relates[2]—In a case of sodomy I examined the catamite, a boy eight years of age, about an hour after the occurrence. There was a slight recent tear near the anus, which was surrounded by pus. The boy had no ulcer, abscess, or dysentery to account for the pus, which contained gonococci and a remarkably large proportion of eosinophile leucocytes. The accused had gonorrhœa, in the discharge of which there were gonococci and a similar unusual proportion of eosinophiles. The next day the boy had no discharge from the anus. A little clear exudation from the tear showed no unusual character in the leucocytes.

To recapitulate.—To distinguish between a gonorrhœal discharge and a muco-purulent discharge, note (1) profusion of discharge; (2) presence or absence of gonococci, or B. coli communis, thread-worms or their ova; (3) duration; (4) response to cleanliness and treatment—prompt in 'dirt' cases, slow in gonorrhœa; (5) locality—urethra often inflamed in gonorrhœa, seldom in other; (6) co-existence of eczema, often in 'dirt' cases.

4. **The age of the victim** of alleged forcible intercourse may have to be determined, especially as *nearly nine-tenths* of the cases of rape in India are on children, and the question arises whether or not she is under twelve years of age, so as to be capable of giving consent to the act, or if she is under sixteen with reference to abduction of a minor for immoral purposes. In England the question of age would be (*a*) is she under thirteen, or (*b*) under sixteen? The following recent case well illustrates how the examination of an alleged victim of rape should be conducted and reported:—

Case.—**False charge of rape and venereal infection.**—In 1901 a girl, aged 10, and her mother charged a wealthy old man with the rape of the former, and with infecting her with gonorrhœa. She was brought by the police for examination, by Dr. A. Powell, three days after the alleged rape. The child is in a poor condition and very dirty. There are no signs of bruising or injury. There is slight muco-purulent discharge from the vulva and vagina. The hymen is slightly swollen, of normal colour, circular with a mesial oval opening. There is no tear or abrasion. The opening will not admit a $\frac{1}{3}$-inch glass rod without tearing or duly stretching. There is a slight eczema intertrigo in the labio-femoral folds. The thighs are stained with green aniline dye. A pair of drawers, dyed a similar colour, are marked by three stains of a brownish-red colour, which are pointed out as blood-stains due to tearing in the act of intercourse. The stains do not give the reactions of blood. Though dry, they are not stiff. Under the microscope they are seen to contain starch

[1] *Ind. Med. Gaz.*, 1902, p. 232. [2] *Ibid.*

cells, spiral vessels, and other vegetable structures, as well as numerous ova of the thread-worm. The discharge from the vagina contains no spermatozoa; pus cells are numerous; there are no gonococci, many short bacilli of a colon type, a few staphylococci which all retain the stain after Gram's process. Opinion.—The child has what are usually considered the signs of virginity. I consider it impossible that a body as large as accused's penis could penetrate the hymen without tearing it. The child has a discharge from the private parts, but I am of opinion that it is not venereal in origin, as the germs usually found in gonorrhœa are absent. Similar discharges are said to frequently arise from the irritation of dirt or worms. There is evidence of the presence of numerous eggs of worms. The child is dirty, and has an eruption, such as would be caused by dirt or an irritating chemical such as was found on her thighs and drawers. The stains alleged to be of blood are not blood: they are human fæces. The discharge from the skin and the private parts is a chronic one, and must have existed for some time.—The accused was released.

Examination of the Accused.

This should ascertain:—(1) His age and capacity for committing the offence; (2) whether his clothes or person exhibit signs of recent sexual intercourse or a struggle; (3) whether he is suffering from venereal disease.

Age and potency.—This is ascertained as already described. As regards age whether he is under seven, or under twelve (p. 42), and as regards impotency see p. 261, also his muscular development.

Signs of recent intercourse.—Glans. If this be covered by uniform layer of *smegma*, it negatives the possibility of recent complete penetration. If not, any abrasions should be noted, especially on frænum.

Stains on clothes or person.—The presence of *semen* on the clothes or person of accused is only evidence of recent emission and may have an innocent explanation, or have been in connection with another woman. **The presence of blood is important** if the alleged victim is a child or virgin; but the stains may have been removed by washing before your examination. It is of the utmost importance in rape cases that the police should not allow the accused person to retire to a water-closet on any pretext before the surgeon has made his examination.

Case.—Dr. A. Powell relates[1]:—A menstruating woman accused a neighbour of rape. He was arrested in her room, but allowed by the police to wash himself. On examining him I found no trace of blood on his private parts. He quite frankly admitted intercourse, but with

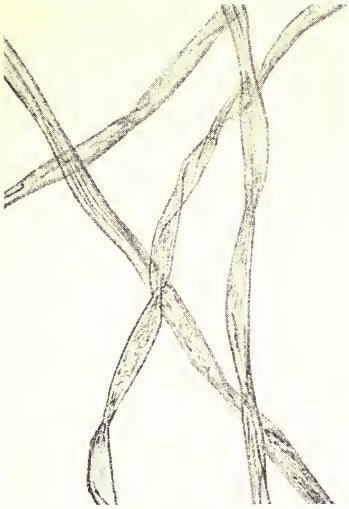
[1] *Ind. Med. Gaz.*, 1902, 231.

consent. He stated the woman only cried out when some friends attempted to enter the room. He added that his penis and hand were covered with blood when arrested, and it was for this reason he went to the latrine and washed.

Stains of mud, etc., derived from the spot where offence is alleged to be committed should be looked for. Any **scratches** or bruises on his body should be noted with reference to a struggle.

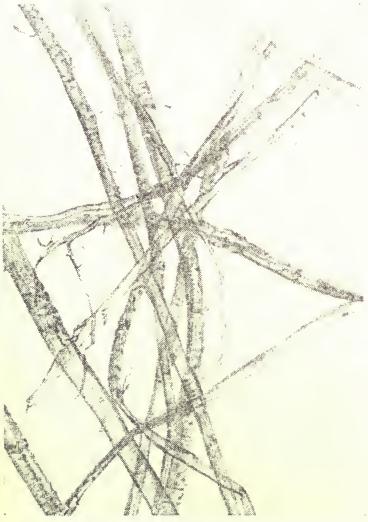
Signs of venereal disease.—If the accused is suffering from venereal disease his discharge should be at once examined, and the character of the pus and any organisms therein compared with any found then or subsequently on the victim (see *Case,* p. 312), and at the same time the presence in it or absence of spermatozoa can be ascertained.

The **Spot** where the offence is alleged to have been committed may show signs of a struggle having taken place, or there may be blood-marks on it, or an impress of the body of the female on the ground.

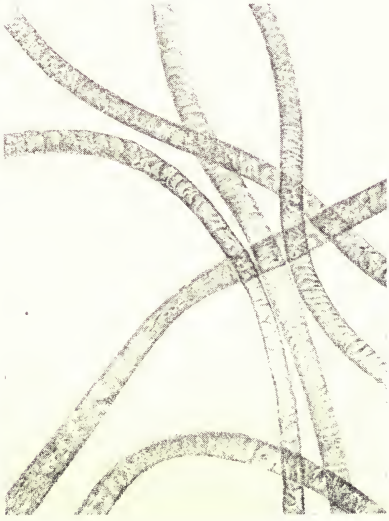


a.—Cotton Fibre × 130.

b.—Silk Fibre × 130.



c.—Linen Fibre × 130.



d.—Sheep's Wool × 130.

(From Micro-Photographs by Dr. H. Gibbes.)

[*To face p.* 314.

CHAPTER XV.

CRIMINAL ABORTION OR MISCARRIAGE—FOETICIDE.

Criminal Abortion or **Foeticide** is undoubtedly very prevalent in India, though only a relatively small proportion of the cases come into the law courts, usually those cases only where the results have proved fatal to the mother, as prosecutions are beset by obvious difficulties and convictions are extremely rare. Amongst Europeans in India cases often occur in medical practice where hæmorrhage, paralysis, and other symptoms are obviously due to the clandestine use of abortifacients. On the frequency of this dangerous and immoral practice amongst Europeans in India an experienced Anglo-Indian physician writes:—"I am afraid that in India inducements to procuring abortion criminally are frequent and strong, and I have known instances in which solicitations in that direction have caused medical men to swerve from the path of rectitude; but apart from considerations of personal reputation and professional honour, the blunt truth should never be forgotten that fœticide is murder, and, if fatal to the unfortunate mother, double murder."

Criminal abortion or 'causing miscarriage' is unlawful expulsion of the fœtus. The term **'miscarriage,'** as used in law, includes both abortion and premature labour. Medical writers, however, restrict the term 'premature labour' to denote premature expulsion of a child that has attained viability, and use the term 'abortion' or 'miscarriage' to signify expulsion of an ovum or fœtus at an earlier period.

Miscarriage may be—(1) Accidental, *i.e.* the result of natural or accidental causes; (2) Justifiable, *i.e.* the result of a lawful act; or (3) Criminal, *i.e.* the result of an unlawful act.

Accidental Miscarriage.

This frequently occurs, and is more common in the earlier than in the later stages of pregnancy. Whitehead, from

observation of 2000 pregnancies, estimates that one in seven end in abortion. Dr. Robert Barnes divides the causes of accidental or natural miscarriage into (1) Maternal, and (2) Fœtal causes, and classifies them thus:—

Maternal causes.—(1) Poisons circulating in the mother's blood: (*a*) introduced from without, as fevers, syphilis, various gases, lead, copper, etc.; (*b*) products of morbid action, as jaundice, albuminuria, carbonic acid from asphyxia, and in the moribund. (2) Diseases impoverishing the blood, *e.g.* anæmia, obstinate vomiting, over-lactation. (3) Circulatory disturbance, *e.g.* liver, heart, and lung disease. (4) Nervous troubles: (*a*) certain nervous diseases, as chorea, etc.; (*b*) mental shock; (*c*) diversion or exhaustion of nerve force, as from obstinate vomiting. (5) Local diseases: (*a*) uterine diseases, as fibroid tumours, inflammation, hypertrophy, etc., of the uterine mucous membrane; (*b*) mechanical anomalies, as retroversion, pressure of tumours external to uterus, etc. (6) Artificially induced abortion.

Foetal causes.—(1) Diseases of the membranes of the ovum, *e.g.* fatty degeneration, hydatidiform degeneration, inflammation, congestion, apoplexy, and fibrous deposits. (2) Also diseases of embryo itself.—Malformation, inflammation of serous membranes, diseases of nervous system, diseases of kidneys, liver, etc., and mechanical, as from torsion of the cord.

Common causes of accidental miscarriage are syphilis, mental shock, and accidental violence. In some women miscarriage results from the slightest exciting cause. Others having once miscarried, miscarry in subsequent pregnancies apparently without any exciting cause. Others, again, seem "proof against the more severe physical injuries and suffering and the most violent mental excitement." [1]

Case.—**Failure of external violence** to cause miscarriage.—In the Assize Court of the Loire-Inférieure it was proved that a peasant who had seduced his servant and wished to make her abort, mounted on a strong horse, and put the girl on the same horse, then galloped wildly hither and thither, throwing her down on the ground whilst in full gallop, and this repeatedly. Having tried this twice without success, he applied to her stomach bread just taken from a very hot oven. This means failed like the former, and the poor victim gave birth to a living and well-formed child at term.—Woodman and Tidy, *For. Med.*, p. 754, from Tardieu.

Case.—**Failure of violence** to cause miscarriage.—A young woman seven months with child had employed savin and other drugs to produce miscarriage. As these failed, her paramour bound a strong leather strap tightly round her body. This, too, availing nothing, he (by his own confession) knelt upon her with all his weight, and trampled on her while she lay on her back. As this also failed, he took a sharp-pointed pair of scissors and proceeded to perforate the uterus through the vagina. Much pain and hæmorrhage ensued, but did not last long. The woman's health did not suffer in the least, and pretty much about the regular time a living child was brought into the world, without any marks of external injury upon it.—Guy, *For. Med.*, p. 87, quoting Dr. Wagner, of Berlin.

[1] Tidy, *Leg. Med.*, II. p. 156.

Justifiable Miscarriage.

In defining the offence of causing miscarriage, *s.* 312 of the *I. P. Code* excepts as not criminal miscarriage caused "in good faith and for the purpose of saving the life of the woman." The law of England does not formally define under what circumstances it is lawful to cause miscarriage. Usually justifiable miscarriage takes the form of "artificial induction of premature labour," *i.e.* the operation is deferred until the child has attained viability, so that, if possible, its life as well as that of the mother may be saved. So long, however, as the operation is undertaken for the purpose of saving the life of the mother, miscarriage may be legally caused at any period of pregnancy. For the purpose of saving the mother's life it may be necessary to cause premature expulsion of the contents of the pregnant uterus in the following cases:—

(1) Pelvic distortion where the antero-posterior diameter of the pelvis (normally $4\frac{1}{4}$ inches at the brim and $4\frac{3}{5}$ inches in the cavity) is reduced below, or to, $3\frac{1}{4}$ inches. (2) Obstruction by the presence of tumours or contractions of the soft parts arising from cicatrices, of such a nature as to prevent the passage of a mature child. (3) Where during gestation the mother's life is endangered by obstinate vomiting, hæmorrhage from placenta prævia, convulsions, or serious cardiac, or pulmonary, or other disease. Dr. Meadows and others advise the artificial induction of premature labour in "cases in which there is evidence that on several previous occasions the death of the fœtus occurred at a given time suddenly. Here," writes Meadows, "the operation would be resorted to prior to the period in question with the view of preventing its recurrence." [1] To cause miscarriage under these circumstances is by the law of India not justifiable, unless there is reason to believe that the child's death will endanger the life of the mother.

Criminal Miscarriage.

Criminal abortion, or miscarriage, common in many countries, is especially common in India. It is resorted to by both single and married women in order to get rid of the product of illicit intercourse or to avoid inconvenient additions to their families. In India the custom of preventing the remarriage of widows tends directly to increase the prevalence of the offence. In India, in fact, in by far the great majority of cases of this offence, the female who has miscarried is a Hindu widow (see *Cases* (*a*), (*b*), pp. 275–6) who resorts to this practice to avoid disgrace. This, however, is not invariably the case (see *Case* (*d*), p. 276). This crime is also not uncommonly practised by European women in India, as already noted.

[1] *Man. of Midwifery*, p. 234.

The sections of the *Indian Penal Code* concerning the offence of causing miscarriage are as follows:—

312. "Whoever voluntarily causes a woman with child to miscarry, shall if such miscarriage be not caused in good faith for the purpose of saving the life of the woman, be punished with imprisonment of either description for a term which may extend to three years, or with fine, or with both; and if the woman be quick with child, shall be punished with imprisonment of either description for a term which may extend to seven years, and shall also be liable to fine." "Explanation.—A woman who causes herself to miscarry is within the meaning of this section."

313. "Whoever commits the offence defined in the last preceding section without the consent of the woman, whether the woman is quick with child or not, shall be punished with transportation for life, or with imprisonment of either description which may extend to ten years, and shall also be liable to fine."

314. "Whoever with intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine; and if the act is done without the consent of the woman, shall be punished either with transportation for life, or with the punishment above mentioned." "Explanation.—It is not essential to this offence that the offender should know that the act is likely to cause death." [Unlike in English Law the question here arises of the consent of the woman.] Two other sections of the Code refer to results which may arise to the child from the doing of certain acts before its birth, namely, *s.* 315; and

316. "Whoever does any act under such circumstances that, if he thereby caused death, he would be guilty of culpable homicide, and does by such act cause the death of a quick unborn child, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine."

Attempts to cause miscarriage may be dealt with either by the application of the provisions of *s.* 511 of the Penal Code to *ss.* 312 or 313; or if the attempt has been made by the administration of an "unwholesome drug or other thing" the case may be dealt with under *s.* 328. Hence by the law of India to voluntarily cause or attempt to cause 'miscarriage,'

except in good faith for the purpose of saving the life of the woman, is an offence; proof of pregnancy, which is required to convict for causing miscarriage, is not required for an 'attempt.'

Further, supposing it to be proved that such an offence has been committed, the following additional questions are, owing to the wording of the above-quoted sections, liable to arise:—(1) Was the woman pregnant? Proof of pregnancy is required to secure a conviction for causing miscarriage, but not to secure conviction for an attempt. (2) Was the woman quick with child? (3) Was the miscarriage caused, or the attempt to cause it made, without the consent of the woman? (4) Did the woman's death result from the miscarriage or the attempt to cause it? And (5) In certain cases (see *ss.* 315 and 316) did the death of the child result from an act done before its birth?

In England, causing miscarriage is punishable by death or imprisonment under *ss.* 58 & 59 of 24 & 25 Vict. c. 100, as amended by 27 & 28 Vict. c. 47.

S. 58. "Every woman being with child who, with intent to procure her own miscarriage, shall unlawfully administer to herself any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever with like intent, and whosoever, with intent to procure the miscarriage of any woman, whether she be or be not with child, shall unlawfully administer, etc., shall be guilty of felony."

S. 59. "Whosoever shall unlawfully supply or procure any poison or other noxious thing, or any instrument or thing whatsoever, knowing that the same is intended to be unlawfully used or employed with intent to procure the miscarriage of any woman, whether she be or be not with child, shall be guilty of misdemeanor, and being convicted thereof, shall be liable, at the discretion of the court, to be kept in penal servitude for the term of three years, or to be imprisoned for any term not exceeding two years."—24 & 25 Vict. c. 100.

N.B.—By 27 & 28 Vict. c. 47, *s.* 2, the minimum term of penal servitude awardable is increased to five years. It may be noted that under these sections (1) the question of pregnancy only arises when a woman is accused of doing an act with intent to procure her own miscarriage; (2) that the question of quickening does not arise at all; and (3) that these sections do not, like those of the Indian code, expressly provide that the absence of the woman's consent aggravates the offence. Further, in England, if the death of the woman results, the ordinary law of homicide applies, the felony is considered to be murder.

Proofs of an Abortion.

In investigating a case of alleged criminal miscarriage examination should be made of:—I. The means alleged to have been used. II. The substances alleged to have been expelled; and III. The woman alleged to have miscarried.

I.—Means alleged to have been used.

The methods of the criminal abortionist are usually of the crudest kind. Miscarriage may have been caused, or an attempt to cause it made, by (1) General violence; (2) Local violence; or (3) Administration of drugs.

(1) General Violence.

Blood-letting has, in some countries, a popular repute as a means of causing miscarriage. Bleeding from the foot, application of leeches to the anus or to the vulva, have all been resorted to. Blood-letting, however, usually fails, and the same may be said of the use of very hot or very cold baths. Violent exercise, such as hard riding; severe jolting, as driving over a rough road; violent shocks, as from blows or falls; and tight compression of the abdomen, may all cause abortion. Often severe general mechanical violence altogether fails (see above cases). Sometimes mechanical violence is combined with the administration of drugs (see following case).

Case.—**Miscarriage caused by drugs** combined with mechanical violence. —In a case from Dohad (Panch Mahals) a quantity of orpiment and ruskapoora—impure calomel—were discovered among matters found in the house of some persons charged with procuring abortion. In this case a woman was heard screaming in a house; the police entered, and found that the screams proceeded from a woman who had aborted, and who on examination told the following story. She said she had been forced against her will to take some medicine brought by the man in whose house she was found. After taking it she suffered from vomiting, and, in about two hours, from pain in the abdomen. As soon as the pain became severe, the man who gave her the medicine seized hold of her hands and feet, and his wife pressed on her abdomen, with the result that abortion was effected.—*Bombay Chem. Analyser's Report*, 1884.

(2) Local Violence (including Local Application).

Rupturing or separating the membranes, with or without dilation of the os; the insertion of a foreign body into the uterus; or the use of the vaginal douche; are the means of inducing premature labour commonly employed by medical practitioners. Similar means are often resorted to by unskilled persons in criminal attempts, and often fatal injury to the mother is the result.

In India a common method employed is the introduction into the vagina or uterus, of either a twig of some irritant plant, or a thin piece of stick armed with some irritant or reputed abortifacient preparation. The plants, twigs of which are most commonly used, are *Plumbago rosea* and *zeylanica*.

(*Lal chitra*), and less frequently *Nerium odorum* (oleander), *Cerbera thevetia* (yellow oleander), and *Euphorbium tirucalli* (milk-bush). The twigs of these plants, previous to introduction, are often smeared with asafœtida (*Hing*). When a piece of stick armed with an irritant or other preparation is employed, the stick is commonly wrapped round at one end or for the greater portion of its length with cotton, and to this the preparation is applied. More or less common ingredients of the preparations employed for arming such sticks are, besides matters derived from the plants just named, the juice of *Jequirity* (*'rati' abrus precatorius*), *Calotropis procera* (*madar*), or the milky juice of various other *Euphorbias*, bruised marking-nuts (*semi-carpis anacardium*), arsenious oxide, orpiment, and red lead. This last (red lead), very commonly in Bombay, forms one of the ingredients of the composition employed.[1]

Sometimes a mass of irritant paste is simply thrust into the upper part of the vagina. Not infrequently the twig or stick employed passes wholly into the uterus, causing fatal inflammation, and after death is found lying wholly or partly within the cavity of the emptied or unemptied uterus, perhaps transfixing its walls. Perforation of the uterine walls by such sticks or twigs may occur from force used in introducing them, or from subsequent contraction of the uterus upon them. Dr. Lyon was present in Bombay at a *post-mortem* examination on an abortion case, in which two thin pieces of stick were found lying side by side in the uterus across the fundus, both transfixing the uterine wall on either side. From their position, these sticks must have been (*a*) retained by the uterus after expulsion of its contents, and (*b*) forced through the uterine wall by the contractions of the uterus. Introduction of irritant twigs, or of sticks armed as described above, appears to be the method usually resorted to in India by practised abortionists, and very often proves successful. It should be noted that irritant substances are sometimes introduced into the vagina as a mode of torture. Dr. W. Gray met with a case in which a man placed three marking-nuts in his wife's vagina, as a punishment for infidelity.[2]

II.—Substances alleged to have been expelled from the Uterus.

(*a*) These may contain no ovum or embryo, *e.g.* they may be blood-clots, a fibroid tumour, a dysmenorrhœal false membrane, a mole, or hydatids. In India, in such a case, the

[1] See 'Lead Poisoning.'

[2] *Bom. Chem. Analyser's Rep.*, 1874–75.

accused can only be convicted of an attempt to cause miscarriage.

In England, except the accused be the female alleged to have miscarried, the nature of the substances expelled from the uterus is immaterial.

(*b*) They may contain an ovum, embryo, or immature fœtus.—As by the law of India causing miscarriage is punishable with greater severity if the woman be quick with child, it is important to determine the uterine age of an immature fœtus found in the matters expelled. For the characters of the fœtus at various periods of gestation, see p. 294. In criminal miscarriage, it may be noted, the usual period selected is during the fifth or sixth month.

Chevers, however, points out that women in India "not infrequently induce premature confinement when they have nearly advanced to their full period."[1] In giving, from examination of the fœtus, an opinion as to whether quickening has occurred, it must be borne in mind that quickening does not take place at any fixed period. After ascertaining the probable uterine age of the fœtus, the question of the cause and time of its death must next be considered. By the law of England, the fact that the death of the child resulted from criminal causing of miscarriage, only affects the gravity of the offence committed in one case, namely, where the child survives its complete birth. In such a case the offence committed is murder according to English law. This is not so in India. In India, however, in certain cases (see Penal Code, *ss.* 315 and 316) the fact that the death of the child resulted renders the offender liable to enhanced punishment.

(*c*) What has been expelled may be a mature child.—In such a case it is of course possible that miscarriage has not occurred at all. When this is suspected, signs indicative of maturity should be carefully looked for. One of the most important of these, only available, however, if the child be dead, is the presence in the lower epiphysis of the femur of a point of ossification more than three-quarters of a line in width. Of course, in all cases where the degree of maturity of the child indicates that it might possibly have been born alive, the questions whether or no it survived its birth, and what was the cause of its death, must be inquired into, as in a case of alleged infanticide.

Administration of Drugs for Miscarriage.

The substances popularly believed to possess abortifacient properties, may conveniently be arranged in five classes, namely, (*a*) Ecbolics; (*b*) Reputed Emmenagogues; (*c*) Purgatives; (*d*) Irritants; and (*e*) Other substances. The clandestine use

[1] *Med. Jur.*, p. 735.

of such abortives by married women, both native and European, may be the cause of apparent menorrhagia, dysentery, paralysis, etc.

(*a*) **Ecbolics,** *i.e.* substances which stimulate the contraction of the muscular fibres of the uterus. The only undoubtedly ecbolic drug known is ergot. Administration of this, after the uterus has begun to contract, nearly always increases the force and frequency of its contractions. When, however, contractions of the uterus have not commenced, administration of ergot may or may not excite their commencement. Apparently, the less advanced the pregnancy, the more likely is it to fail. Hence, when given with criminal intent, as is frequently the case in England, it often fails to cause abortion. Ergot has been stated to act injuriously on the child. Dr. U. West,[1] however, records that out of one hundred and seventy-two labours in which he gave ergot, only five still births resulted, or considerably less than the usual percentage of still to live births.[2] Borax has been stated to possess ecobolic action, but this is extremely doubtful. Cotton root bark is said to act on the uterus like ergot, and has been used as a substitute for it.[3]

(*b*) **Reputed emmenagogues,** *i.e.* substances believed to promote the menstrual flow. The principal substance of this class used criminally as an abortifacient, is Savin (*Juniperus sobina*). This is frequently employed in England, both in the form of powdered leaves (or a decoction made from them), and in the form of oil of savin. It often occasions abortion, but often fails. When given in large doses for the purpose of procuring abortion, it acts as a powerful irritant poison, and has in several cases caused death.

The following reputed emmenagogue poisonous plants have also been criminally employed in Europe:—Rue (*Ruta graveolens*), Yew (*Taxus baccata*), Tansy (*Tanacetum vulgare*), and, in India, Oleander (*Nerium odorum* and *Cerbera thevetia*). All these are powerful poisons: the first two have caused abortion, the others are not known to have any effect on the uterus. Single cases of abortion, following internal administration of Actea racemosa (black snake root, or cohosh), and digitalis, the latter resulting fatally to the mother, have also been reported.

Less active or non-poisonous drugs of this class are:—Pennyroyal (*Mentha pulegium*). This has been used in England for the purpose of procuring abortion. Most authorities consider it to be without action on the uterus, and many do not even consider it to be a noxious substance.[4] Tidy, however, doubts its absolute innocence.[5]

Papaya seeds (*Carica papaya*) and carrot seeds (*Daucus carota*), *vern.* Gájir-bij, are both popularly believed in India to be powerfully abortifacient. In regard to the first, Dymock[6] states that the general belief among all classes of women in Southern and Western India, is that if a pregnant woman partakes of them even in moderate quantity, abortion will be the probable result. As regards the second, numerous cases are recorded where carrot seeds have been given internally, their administration being followed by abortion. More precise information is much wanted as to the alleged abortifacient power of both these drugs.

(*c*) **Purgatives,** especially such as cause much straining, or act powerfully on the rectum, may, if given in large doses, bring on abortion.

[1] Taylor, *Med. Jur.*, II., p. 192.
[2] 5¼ per cent.
[3] Lauder Brunton's *Pharmacology*, p. 788.
[4] Taylor, *Med. Jur.*, II., p. 185.
[5] Tidy, *Leg. Med.*, II., p. 169.
[6] *Mat. Med. of W. India*, p. 295.

This effect is more likely to result in the advanced than in the earlier stages of pregnancy.

In India, various Cucurbitaceous tubers, namely Cucumis trigonus (*Karit*), *Momordica Charnatia* (*Kerala*), and Momordica Cymbalaria (*Kadavanchi*) have been used, it is alleged, with success. Aloes, in the form of Hierapicra (a mixture of powdered aloes and powdered canella bark), and Pilacotia (a mixture of aloes and colocynth) has frequently been used in England as an abortifacient. Sulphate of potash is said to be much employed for the same purpose in France. Again, Taylor gives an English case where one hundred and twenty grains of colocynth taken with intent to excite abortion, caused death.[1] Elaterium, Croton oil, and Gamboge may also be classed as purgatives, likely, under certain circumstances, to cause abortion.

(*d*) **Irritants.**—Powerful irritants may, like purgatives, cause abortion owing to the uterus participating in the irritant action set up in the system. Obviously, if given to an extent which renders abortion probable, the death of the mother is likely to result. Mineral irritants which have been used, may be mentioned:—(1) Arsenic; this is sometimes employed in India; it has, in more than one case, caused death without producing abortion (see *Case* (*d*), p. 276). (2) Iron; the sulphate and the tincture of the perchloride have been used in England: neither of the preparations appear to possess any specific abortifacient power. (3) Mercury; this has been used in England in the metallic form, and as calomel, but without success. Chevers mentions an Indian case where mercuric sulphide formed one of the ingredients of a powder given with intent to cause abortion.

Organic Irritants: Plumbago (*rosea* and *zeylanica*), the juice of various Euphorbias, and the juice of the *Calotropis procera*, are all in more or less common use in India for internal administration as abortifacients. Chevers also mentions as similarly used black pepper, unripe pineapple, the bark of *Moringa pterygosperma* (horse-radish tree), and blistering flies. Copper and lead salts have been used. Quinine is very commonly used in India as an abortifacient and sometimes produces the desired result.

Case.—**Abortion by quinine.** "A Eurasian woman in Bombay took five drachms of quinine as an abortifacient. Three days later she gave birth to a five-months fœtus. She was for weeks in a very precarious condition as a result of quinine poisoning. Collapse, feeble pulse, great pallor, dyspnœa, muscular weakness, deafness almost complete for over a month; her vision was reduced to mere perception of light for ten days, and four months after she could not read. The retina was remarkably pale and the calibre of the retinal vessels greatly reduced."—Prof. Powell's *Reports*, 1917.

(*e*) **Other substances.**—Numerous other substances, none of which so far as known possess any specific abortifacient power, are mentioned by various writers as enjoying more or less popular repute as ecbolics.

In India, the juice of bamboo leaves; the fruit of Randia dumetorum (*Main-phal* or *Gela-phal*), an emetic recommended as a substitute for ipecacuanha in dysentery; a decoction of *Cuscuta reflexa* (*Akasweli*, *Ghagar bel*); the seeds of *Celastrus paniculata* (*Malkangni*); and the seeds of *Anethum graveolens* or Sowa (Indian dill), have all been used. See also, under 'Poisons,' *Dolichandrone falcata* and *Plumieria acutifolia*.

[1] *On Poisons*, p. 522.

In Europe, squills, hellebore, and laburnum have all three been employed as abortifacients. So also have the following: sarsaparilla, guinea pepper (grains of paradise), saffron, guaiacum, horehound, camomile, wormwood, mugwort, and juniper.

III.—Examination of the Woman.

During life, traces left by the means employed may be found on the person of the female, *e.g.* bruises on the abdomen, marks of injury on the genitals, or foreign bodies in the vagina. If miscarriage has actually been caused, the signs of recent delivery may be present. These obviously are less marked, the earlier the period of gestation at which the miscarriage has taken place, and the longer the interval which has elapsed since it occurred. In a case no signs of an alleged abortion at three months were present seven days after the event; on the other hand, the same compiler (Harvey) mentions a case where relaxation of the genitals was found six or seven days after abortion at two to two and a quarter months, and another, where in a woman *æt.* twenty-two, eight days after abortion at four months, the following signs were found: vagina slightly dilated, puerperal smell distinct, the uterus could be felt through the abdominal wall, and a little milk could be squeezed from the breasts. In other cases signs sufficient to indicate abortion were reported to be present a fortnight to a month after the occurrence.[1]

After death.—Further traces left by the means employed may be found, *e.g.* extravasation of blood underlying bruises, internal wounds, signs of irritation on the mucous membrane of the alimentary canal, presence of poisons, etc. In addition to the signs of recent delivery present during life, others become available, derived from examination of (1) the uterus, and (2) the ovaries.

1. **The uterus.**—This may be found enlarged, the enlargement being greater, the more advanced the period of gestation at which delivery took place, and the less the time which has elapsed since the event. Montgomery gives its dimensions a day or two after delivery at the full term, as 7 to 8 inches by 4 inches, and its weight as 1½ lbs. Fourteen days after delivery at the full term, it does not exceed 5 inches in length, and weighs about ¾ lb. If delivery has taken place at five months, the uterus, according to the same authority, will be found

[1] Bengal *Med. Leg. Rep.*, 1870–72, p. 297.

immediately afterwards to measure $5\frac{5}{8}$ by $3\frac{3}{4}$ inches; and fourteen days afterwards, $4\frac{1}{2}$ by $2\frac{3}{4}$ inches. On internal examination within a few hours of delivery at the full term, coagula, or fluid tinged with blood, will be found in the cavity. At the seat of attachment of the placenta, the substance of the organ will be found exposed, showing large valvular openings. The inner surface is extremely dark, almost black in colour, and portions of the decidua, intermixed with flakes of lymph, adhere to it. These appearances also are less marked the earlier the period of gestation, and the longer the time which has elapsed since expulsion of the uterine contents. As already pointed out, twigs of irritant plants, or pieces of stick, may, in abortion cases, be found in the cavity of the uterus, or transfixing its walls.

2. **The ovaries.**—Ordinarily at each menstruation an ovum escapes from the ovary, leaving behind it a cicatrix called a corpus luteum. As a rule, this cicatrix undergoes a peculiar development during pregnancy; but does not undergo such development if the escape of the ovum is not followed by pregnancy. Hence corpora lutea are distinguished as true and false, meaning by a 'true corpus luteum,' the corpus luteum of pregnancy, and by a 'false corpus luteum,' the corpus luteum of the unimpregnated female. In some exceptional cases, the development of the cicatrix and its conversion into a body not distinguishable from a true corpus luteum, has been found to occur in the unimpregnated female; and *vice versâ*, in other exceptional cases, no such developed cicatrix has been found in a pregnant female.

On this important matter Professor Powell has put the subject very clearly and concisely. He says: "At each menstrual period an ovum escapes from the ovary leaving the Graafian follicle distended with blood. If pregnancy does not follow, this blood becomes absorbed so that at the end of two months there is in most cases only a trifling scar to indicate its position. Should pregnancy, however, ensue, in most cases the wall of the follicle becomes thickened, convoluted, and of a yellow colour; the central clot becomes fibrinized and decolorized. At the ninth month the whole scar is usually about half an inch in diameter and has received the name, 'corpus luteum.'"

These changes are by no means constant in pregnancy and may take place in a virgin's ovary.

As they can only be found *post mortem* when more definite evidence of pregnancy can be obtained in the uterus, breasts, etc., their value as evidence is slight and unreliable.

Post mortem delivery.

In examining the dead body of a female alleged to have miscarried, the possibility of the occurrence of this accident must not be forgotten. *Post mortem* delivery, owing to the pressure of gases evolved during putrefaction, may occur after death at any period of gestation. It may or may not be accompanied by inversion of the uterus. Inversion even of the non-gravid uterus may occur from the same cause. In the Bengal Medico-legal Reports for the three years ending 1872, nine or ten cases of *post mortem* delivery are cited, and several of *post mortem* inversion of the non-gravid uterus were reported during this period. For a typical case of *post mortem* delivery, see the following:—

Case.—**Post mortem delivery.**—A Mussulmani, aged about twenty-seven, at about the full term of pregnancy, committed suicide by drowning. Three days after she was missed, her body was found in a well much decomposed, but presenting no signs of delivery. It was left all day lying on the ground in the sun (in June), a woman, a relative, watching it from a little distance. No one touched the body during the day, and the watcher observed no sound or movement in it. In the evening, however, when the corpse was being lifted on to a charpoy (sleeping cot), something was noticed hanging between its legs. At the *post mortem* examination it was found that "the uterus, with all its contents, had emerged from the vagina, and was turned inside out. The contents were a full-grown male fœtus, with the remains of the membranes, funis, and placenta, all continuous with each other, but detached from the uterus." No attempt to cause abortion had been made, and no signs indicating that any such attempt had been made, were to be seen.—Dr. Wright, Jaunpur, *Ind. Med. Gaz.*, 1887, p. 296.

CHAPTER XVI.

INFANTICIDE.

'INFANTICIDE' is a term popularly used to denote the murder or homicide of a newly born infant. The law, however, draws no such distinction; infanticide is homicide in law, and the provisions of the law which apply to homicide apply equally to infanticide. But although the law draws no distinction between infanticide and homicide, the subject of infanticide requires special consideration on account of (1) the frequency of the crime, and (2) the special questions which arise.

(1) Cause and Frequency.

Infanticide is common in almost all countries, the motive being generally to get rid of an illegitimate child, or less commonly, to get rid of a child the parents are too poor to support. In India two forms of infanticide may be said to exist, namely, (1) infanticide irrespective of the sex of the child, and (2) infanticide of female children.

As regards the first of these forms of infanticide, the motives leading to it in India are similar to those which lead to it in other countries. Its frequency in India is, however, specially affected by certain social customs, viz. (*a*) early marriage, which tends to diminish the frequency of the crime; and (*b*) prohibition, especially among higher caste Hindus, of widow remarriage, which tends to increase its frequency. As a consequence, therefore, while in European countries the accused is most frequently an unmarried female, in India the accused is very frequently a Hindu widow.

The second form of infanticide may be said to be special to the East. In India the motives leading to it are: (*a*) family pride among certain divisions of the warrior caste (Kshatri), notably the Rajputs and Thakurs, and consequent fear that a husband of suitable rank and position may not be found for the girl; (*b*) the extravagant expenditure entailed by custom on the parents at the marriage of a daughter; and (*c*) the disgrace which by social custom is attached to the father of a girl who attains puberty unmarried. Notwithstanding the fact that in India, owing to the exertions of the British Government, this second form of infanticide had been rendered much less prevalent, it was considered necessary in 1870 to pass

a special Act for its repression,[1] and even now the crime is far from rare. Some idea of the extent to which it was practised may be found from the facts which came out in the course of an inquiry ordered by Government previous to the passing of the Act. It was found, for example, that in many villages of the Benares district, there were no girls at all. In Mainpuri again, out of thirty villages, in eleven there were no girls; and in the whole thirty, only 37 girls to 329 boys. Again in the United Provinces, in seven villages inhabited by Rajputs, there were 104 boys to one girl, and in nine other villages 71 boys to seven girls.[2] In Kathiawar and Kutch also the practice largely prevailed; in the latter province in 1840 "there were only 335 females to 4912 males of pure Jadeja (Rajput) blood."[3] Further it was shown that where measures for the repression of the crime had been adopted, the result was to greatly increase the number of female children. In Mainpuri, for example, the number of Rajput girls rose in thirteen years from nil to 250, and in the Agra district the number of girls was doubled in a few years.

(2) Questions in Infanticide.

It has already been stated that the legal term 'homicide' means the destroying of a human being. According to the criminal law of England, an infant is not considered a human being until the moment it is completely born, *i.e.* completely and wholly external to the mother, irrespective of whether or no it be still attached to the mother by the umbilical cord. Hence, according to English law, the destruction of an infant before its complete birth has taken place is not homicide.

According to the law of India, however, so far as homicide is concerned, a child is "in being" from the moment "any part of that child has been brought forth, though the child may not have breathed or been completely born."[4] Hence, according to Indian law, killing an infant before any part of it is born is not homicide. Further, if the result of an act is to cause a child to die after its complete birth, the doing of the act is not punishable as culpable homicide. Section 315 of the Indian Penal Code states: "Whoever before the birth of any child does any act with the intention of thereby preventing that child from being born alive, or causing it to die after its birth,

[1] Act VIII. of 1870. The chief provisions of this Act are as follows:—Power is given to the Local Governments to apply the Act to any district or class, and thereafter (subject to confirmation by the Government of India) to make rules applicable to such district or class: (1) for the registration of births, marriages, and deaths; (2) for the regulation and limitation of marriage expenses; and (3) for the establishment of punitive police posts.

[2] Chevers, *Med. Jur.*, p. 755.

[3] These figures in 1873 had risen to 4272 females to 8371 males (Cooke on the 'Repression of Female Infanticide in Bombay,' 1875).

[4] "The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child if any part of that child has been brought forth, though the child may not have breathed or been completely born."—*I. P. Code*, *s.* 299, expl. 3.

and does by such act prevent that child from being born alive, or causes it to die after its birth, shall, if such act be not caused in good faith for the purpose of saving the life of the mother, be punished with imprisonment of either description for a term which may extend to ten years, or with fine, or with both." This is not so in England. By English law, the doing, before the birth of a child, of a felonious act, the result of which is to cause the child to die after its complete birth, is murder.

Investigation.

Hence the chief medico-legal questions which arise in cases of alleged infanticide are: (1) Did this child live after its birth? This question, for the purposes of English criminal law, must be read as if the latter part of it stood "after its complete birth," while for the purposes of Indian criminal law it must be read as if the latter part of it stood "after any part of it was born." (2) What was the cause of the child's death? and (3) Does this woman exhibit signs of having been delivered (or recently delivered) of a child? These imply examination of the child and of the mother.

Examination of the Child.

LIVE BIRTH—DID THIS CHILD LIVE AFTER ITS BIRTH?

In cases of alleged infanticide it has always been the practice of the English courts to require, in order to establish the fact of live birth, much stronger evidence than they will accept as proof of the same fact in civil cases. Moreover, in an infanticide case it is possible that the fact that the child lived after its birth may be capable of being established by the evidence of ordinary witnesses, *e.g.* of individuals who saw the child move, or heard it cry. In regard to crying as a proof of live birth—and it appears that the word 'still-born' means 'silent-born'[1]—it must be noted that it is possible that a child may be heard to cry before birth, and while its head is still in the uterus (*vagitus uterinus*), or in the vagina (*vagitus vaginalis*). Several authentic cases of vagitus uterinus (Dr. Ogston has collected nine[2]) have been recorded (see the following case), and several others of vagitus vaginalis.

In all the authentic cases of vagitus uterinus or vagitus vaginalis which have been reported, a passage by which air could reach the mouth of the child was provided, by the introduction of the hand or instruments, into the uterus or vagina. Although therefore it must be admitted that a child may be heard to cry before any part of it has been born, there is

[1] *Notes and Queries*, April 4, 1904. [2] *Lect. Med. Jur.*, pp. 247 *et seq.*

no doubt but that such cases are extremely rare, and have only been known to occur under the special circumstances stated above. Obviously, also, a child may be heard to cry after the birth of the head and before complete birth; the question, however, whether or no the crying took place after partial, but before complete birth, would not be material in a case of alleged infanticide in India, although it might be so in an English case.

Case.—**Vagitus uterinus.**—"In 1834 Dr. Joubert was called to assist in the delivery of a woman with a deformed pelvis, who had had two abortions previously. After strong pains the membranes had ruptured forty-eight hours before his visit. On examining the woman he found the head of the child above the brim of the pelvis, the occiput and face towards the right and left iliac fossæ. The parietal bones had alone entered the brim of the pelvis. The os uteri was dilated to about 2 inches. As the narrowness of the antero-posterior diameter of the pelvis proved an obstacle to the descent of the head, the forceps was applied to it, when, at the moment the operator commenced his attempts at extraction, the fœtus, during some seconds, uttered repeated and distinct cries which were heard by all in the room. After this, while considering whether it would be advisable to bring down the feet, from the little effect produced by the forceps, the cries were renewed as distinctly as before, as from the effect of repeated inspirations. Finally, when introducing his hand in order to lay hold of the feet, the moment it passed over the left shoulder, the fœtus for the third time uttered cries, less prolonged than before, yet sufficiently loud to be heard by all present."—Ogston, *Med. Jur. Lect.*, p. 247.

As a rule, however, in cases of alleged infanticide, the only evidence of live birth available is the opinion of an expert founded on *post mortem* examination of the body of the infant. In giving such an opinion the following points must be considered:—(1) What is the degree of maturity of the child? (2) Does it show signs of having breathed? (3) Does it show any signs of live birth other than such as are directly due to the establishment of respiration? (4) Does it show signs of having been born dead?

THE DEGREE OF MATURITY OF THE CHILD.

In order to establish the fact that infanticide has been committed, the law (both of England and of India) requires it to be proved that the child was born alive; not that it was born 'viable' or capable of living and being reared. The degree of maturity of the child, however, is a factor which must be taken into account in framing an answer to the question, Did this child live after its birth? because the less the degree of maturity, the less the probability of live birth. Indeed, in the case of a child born before the 120th day of intra-uterine life the possibility of live birth may be altogether excluded. (For the characters whereby the degree of maturity can be ascertained, see p. 294.)

Does the child show signs of having breathed?—When respiration has been fully established certain changes will be found to have taken place **in the lungs,** viz. (1) they alter in appearance and feel; (2) they increase in weight; and (3) their specific gravity is lowered.

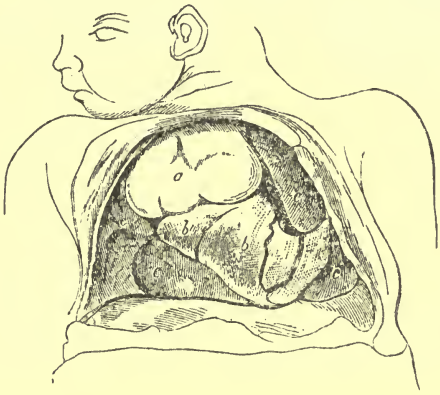


FIG. 26.—Infantile Lungs *before* breathing.[1]

(1) Altered appearance, etc., of lungs :—

Before Respiration.	After Respiration.
Uniform dark liver colour.	Mottled red or pink and grey with blood vessels over surface.
Solid, occupy only the upper dorsal part of the chest, leaving pericardium exposed.	Expanded and reach the sides of the pericardium.
Not crepitant when handled or cut, and exude little blood on section.	Crepitate when handled or cut, and exude frothy blood on section.
No inflated air vesicles visible, but possibly bubbles of gas due to putrefaction present on surface of the lung. These are :— (1) Large and not uniform; (2) Not in groups; (3) Project considerably from the surface of the lung; and (4) The gas in them can be pushed readily from place to place. (5) Bubbles collapse on pricking.	Inflated air vesicles visible on surface of lung. These are :— (1) Small, nearly uniform; (2) In Groups; (3) Project only slightly, or not at all; and (4) Cannot be pushed from place to place.

[1] After Guy and Ferrier, p. 116.

(2) **Increase in weight of lungs,** owing to the increased amount of blood they contain.—Hence a test for establishment of respiration has been proposed from the absolute weight of the lungs (Schmidt's test).

As regards this test Guy (from over 400 cases) gives the following as the average weight of the lungs in mature children: Before respiration, 874 grains; after respiration, 1072 grains. Individual cases, however, depart so greatly from these averages as to make this test most untrustworthy. Thus, in nine of Guy's cases, the weight of the lungs of children that had breathed was below 874 grains (the average in stillborn children), and in four of the nine below 600 grains. Again, Ogston gives a case where after respiration the lungs weighed only 420 grains. Further, in three of Guy's cases, the weights of the lungs of stillborn children were as follows: 1054, 1480, and 1950 grains, and in two of Ogston's cases, 1180 and 1315 grains.

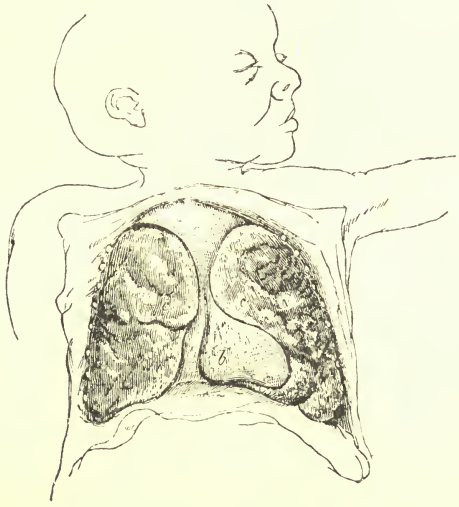


FIG. 27.—Infantile Lungs *after* breathing for *several days.*[1]

N.B.—Such expansion is only got when child has lived for several days, and seldom then.

(3) **Lungs specific gravity is lowered.**—In the fœtal condition and before distension with air, the lungs are heavier than water. After distension with air they become lighter than water.[2] Hence if a portion of an undistended lung be thrown into water it sinks, while a portion of a distended lung floats. On this is founded

[1] Guy and Ferrier.

[2] Taylor found the sp. gr. of undistended lungs to be 1·04, 1·05, and the sp. gr. of the lungs of an infant that had breathed to be 0·94.

The Hydrostatic Test.

Procedure.—The tests should be conducted as follows. The water employed should be of a specific gravity as near 1000 as possible, *e.g.* rain-water, or nearly pure water at 60° Fahrenheit.[1] With this a glass vessel, large enough to allow of the lungs floating, should be nearly filled. The lungs, with the heart attached, having been removed from the body, are to be placed in the vessel, and it is to be noted whether they float or sink. Next, each lung, detached from the heart, is to be separately and similarly tried; then each lung is to be cut into about twelve pieces and each piece also tried. Lastly, it is to be noted whether the pieces, if they float, continue to float after firm but moderate pressure has been applied to them. The pressure should be applied by firmly squeezing each piece separately under water between the finger and thumb. If the gas present be only that due to decomposition it will escape as *large bubbles*, and the piece will subsequently sink. If the air present be due to respiration only, part of this can be expelled and will rise to the surface as a stream of *minute-dots*. The pieces of lung will continue to float unless in advanced decomposition or if undue violence be used in squeezing.

Objections.—It has been objected to the presumption upon which this hydrostatic test is founded that:—

1. **Undistended portions** of lung may float in water, owing to the presence in the intercellular tissue of air-emphysema, or gases generated by putrefaction. This undoubtedly may occur. But air or gases present in the intercellular tissue of a portion of a lung may be expelled therefrom by moderate pressure. On the other hand, moderate pressure on a fair-sized piece of a distended lung fails to expel any notable quantity of the air contained in its air-vesicles. Hence, if such a piece of a lung continues to float after moderate pressure has been applied to it, we may infer that the flotation is due to distension of its air-vesicles, and not to emphysema or putrefaction. When, however, the lungs are in an advanced state of putrefaction, moderate pressure will not expel the whole of the putrefactive gases present in the intercellular tissue; and may even break up the lung tissue and cause expulsion of air from its air-vesicles. Hence it is advisable to refrain from drawing any inference from the floating or sinking of portions of the lungs, when these are in a highly putrid condition. *In situ*, however, the lungs putrefy comparatively slowly, and hence, unless general putrefaction of the body is far advanced, their condition is not likely to be such as to make it unsafe to draw decided inferences from the results of the hydrostatic test.

[1] Rise of temperature lowers the sp. gr. of water; dissolved solid matters raise it. If the water is nearly pure, and its temperature is about 80° Fahr., about three ounces of common salt dissolved in five gallons of the water will restore its sp. gr. to about 1000. For water at 90° Fahr. the quantity required is about five ounces of salt to five gallons of water.

2. **Portions of the Distended Lungs** may sink in water owing to disease, *e.g.* congenital tumours, œdema, congestion, hepatization, etc. This is also true. Hence, therefore, if *post mortem* examination shows the existence of very extensive disease of the lungs, we ought logically to refrain from drawing the inference that no portion of either lung has been distended with air, because all portions sink in water. Practically, however, as (1) cases of such very extensive disease of the lungs are extremely rare in newly born infants, and (2) no harm results in criminal cases if the inference drawn is, that the lungs have not been distended, the objection that portions of the distended lungs may sink owing to disease may be disregarded.

Inferences.—Given, then, that the following conditions are complied with:—(*a*) that the lungs are not in an advanced state of putrefaction; (*b*) that each lung is cut into, say, twelve tolerably equal-sized pieces; and (*c*) that firm but moderate pressure has been applied to each piece; we may safely conclude that each piece that sinks has not been distended with air, and that each piece that floats has been distended with air.

Hydrostatic Test as Evidence of Respiration.

Conducting the test as directed, and finding that each piece of lung sinks, we come to the conclusion that no portion of either lung has been distended with air, we may practically conclude that respiration has not taken place because: (1) Infants are not known to live for several hours after birth without any portion of their lungs having become distended with air; and (2) in criminal cases, no harm results from drawing the inference that respiration has not taken place. If, however, we find that some or all portions of the lungs have been distended with air, what inference may we then draw as regards respiration? Here it must be pointed out that distension with air may be due either to (*a*) artificial inflation, or (*b*) natural respiration, and that it is only when the first of these two causes of distension has been excluded, that we may with safety draw the conclusion, that the distension observed is the result of natural respiration.

Artificial inflation is, however, contra-indicated: (*a'*) if every portion of either lung is distended, because it is extremely difficult even by skilled manipulation to effect complete distension of both lungs *in situ;* so difficult, in fact, that Ogston and others entirely deny the possibility of effecting it; (*b'*) if the lungs on section exude much frothy blood; and (*c'*) if the stomach and intestines are free from air, for it is impossible to inflate the lungs from the mouth without a large proportion of air getting into the stomach. The circumstances of the case also may be, and in infanticide cases generally are, such as to exclude artificial inflation, or at any rate skilled artificial inflation.

Hence, then, if attending to the precautions specified, we come to the conclusion (every piece floating), that every portion of the lungs has been distended with air, we practically, in cases of infanticide, may safely infer that respiration has taken

place. If, however, we come to the conclusion (some pieces floating and others sinking), that portions of the lungs only have been distended with air; the inference is, that either artificial inflation has been effected, or natural respiration has taken place. The question to which of these causes the distension is due, cannot be decided by the hydrostatic test alone, and in many cases also cannot be decided without taking into account the circumstances of the case. The existence in the otherwise distended lungs of portions in an undistended condition, has been noticed in children in whom natural respiration has been established, and has been described under the name of *atelectasis pulmonum*.

Other evidences of respiration.—If the changes in the lungs indicate that respiration has taken place, no confirmatory evidence is needed; but such may be afforded by the condition of the anterior chest wall, and condition of the diaphragm. After respiration has been established, the former becomes more arched, and the upper surface of the latter becomes less convex and lies lower. Finding the upper surface of the diaphragm at a level corresponding to between the fifth and sixth ribs, may be regarded as confirmatory evidence of the establishment of respiration.[1]

Respiration as Evidence of Live Birth.

It must be pointed out that the two questions, Did this child breathe? and did this child live after its birth? are not strictly concurrent, and that a negative or affirmative answer to the first, does not necessarily involve a similar answer to the second, because—

(*a*) **A child may live** after its birth without respiring, or may respire so imperfectly that it may be impossible by *post mortem* examination to obtain satisfactory proof that respiration has taken place.

(*b*) **A child may respire** before any part of it has been born.—That this is possible is shown by the fact that cases of vagitus uterinus and vagitus vaginalis have been recorded. Respiration before birth is, however, (1) only likely to occur in a case of face presentation or under conditions similar to those present in the recorded cases of vagitus uterinus or vaginalis; (2) extremely rare; and (3) not likely to be anything more than imperfect, and not likely, therefore, to cause full distension of every part of the lungs.

These two cases excepted, it is obvious that in a criminal case in India, proof that respiration has taken place *de facto*, amounts to proof of live birth, and *vice versâ*.

In criminal cases in England a third possibility must be excepted, viz.:
(*c*) **A child may respire** after partial and before complete birth.—The

[1] The position of the diaphragm should be ascertained from below *before* the thorax is opened.

possibility of the occurrence of this is beyond doubt. Whether, however, this has or has not occurred, cannot possibly be decided by *post mortem* examination.

Does this child show signs of live birth, other than those directly due to the establishment of respiration?

The most important signs of live birth coming under this description are—

(*a*) **Presence of food**, *e.g.* milk, or of drugs in the stomach.—This affords conclusive evidence of live birth.

(*b*) **Complete absence of meconium from the intestines.**—In exceptional cases, the meconium is completely expelled before birth: but, as a rule, its complete expulsion is not effected until some hours after birth. Hence complete absence of the meconium from the intestines affords strong but not conclusive evidence of live birth.

(*c*) **Exfoliation** of the scarf-skin.—This generally commences about the first day after birth, but sometimes not till later, and may not be complete for a month or more. It is difficult, however, sometimes to distinguish this vital change from peeling of the cuticle resulting from intra-uterine maceration.

(*d*) **Changes** in and about the umbilical cord.—These are: (1) Obliteration of its vessels (the arteries first), commencing about twenty-four hours after birth, and, according to Billard, taking place by concentric thickening. (2) Formation (generally about the third day) of a ring of inflammatory redness round the insertion of the cord, accompanied by thickening, and often by a slight purulent discharge. This ring of inflammatory redness must not be confounded with a narrower red line round the insertion of the cord, often present at birth. (3) Falling off of the cord, occurring about the fifth day (in exceptional cases, as early as the second, or as late as the tenth); and cicatrization of the umbilicus, generally complete about the tenth to the twelfth day. Shrinking and withering of the cord commences soon after birth, but not being a vital change, is not a sign of live birth.

(*e*) **Closure** of the special channels of fœtal circulation.—(1) The internal portions of the umbilical arteries (hypogastric arteries); the internal portions of the umbilical vein, and its continuation, the ductus venosus. The concentric thickening of these commencing at the umbilicus (see above) continues; at the end of two days the arteries are contracted for the greater portion of their length, and by the end of the third day the contraction has nearly reached their termination in the iliacs. The vein and ductus venosus contract more slowly, showing only slight contraction for the first three days, which becomes more marked on the fourth day, and is, with few exceptions, complete on the fifth (Guy). (2) The ductus arteriosus.—This begins to contract (at the aortic end first) as soon as respiration is established. The contraction extends throughout the whole length usually during the first day. On the second day, the channel becomes narrowed to the size of a crow-quill, and the lumea is usually closed about the tenth day. (3) The foramen ovale usually closes between the second and the tenth day. In exceptional cases, closure before birth has been recorded in the case of the foramen ovale; and within, at any rate, ten minutes of birth, in the case of the ductus arteriosus. No case of closure before birth of the ductus venosus is on record. The foramen ovale sometimes does not close till the end of

the second year. Sometimes the foramen ovale, or the ductus arteriosus, remains patent throughout life.

(*f*) **Other signs** of live birth which have been advanced are:—(1) Emptiness of the urinary bladder; this is wholly unreliable, and (2) presence of air in the cavity of the tympanum, replacing the gelatinous matter with which this cavity before birth is filled. This indicates that respiration has taken place. As, however, the replacement may not occur for five weeks (Tidy), absence of air from the cavity of the tympanum is wholly unreliable as a sign of still-birth, or of death soon after birth.

Certain of the foregoing signs of live birth may be utilized for the purpose of determining how long a child has survived its birth (see following *tables*).

PROPORTION OF CASES IN WHICH THE FORAMEN OVALE AND DUCTUS ARTERIOSUS HAVE BEEN FOUND OPEN AT VARIOUS PERIODS AFTER BIRTH.

The third column shows (calculated from Tardieu as quoted by Tidy) the proportion of cases in which separation of the cord was found to have taken place (Guy).

Day.	Foramen ovale open in cases, per cent.	Ductus arteriosus open in cases, per cent.	Cords separated in cases, per cent.
1	74	68	—
2	68	59	3
3	64	68	17
4	63	63	40
5	45	52	70
6	—	—	90
7	—	—	95
8	25	15	97

CHANGES WHICH OCCUR DURING THE FIRST FEW DAYS AFTER BIRTH.
(Tidy modified.)

Period after birth.	Conditions observed.
A few minutes to some hours	The stomach contains a frothy fluid, and clots will be found in the vessels of the umbilical cord.
After 24 hours ..	Concentric thickening of the umbilical arteries near umbilicus.
After 2nd day	Contraction throughout the greater part of the umbilical arteries. Epidermis beginning to exfoliate.
After 3rd day	Umbilical arteries contracted throughout. Slight contraction of the umbilical veins. Formation of inflamed ring round cord.
After 4th day	Cord separated.
After 5th day	Contraction of umbilical veins complete.
8th to 10th day ..	Fœtal circulatory openings obliterated.

Does this child show signs of having been born dead? The body may show signs of intra-uterine maceration.

This is readily distinguished from ordinary putrefaction. In intra-uterine maceration (1) the odour exhaled by the body differs markedly from the odour of ordinary putrefaction. (2) The skin is coppery red, or flesh-coloured, not green. (3) The bones are more or less separated, and the body is flaccid, the head, thorax, and abdomen flattening out when the body is placed on a level surface. It must be recollected, however, (*a*) that when death has occurred shortly before delivery, signs indicating intra-uterine maceration will be absent; and (*b*) that after delivery, ordinary putrefaction may supervene and mask the appearances resulting from intra-uterine maceration. Hence, therefore, while the presence of distinct signs of intra-uterine maceration amounts to positive proof of still birth, no inference can be drawn from the absence of such signs.

What was the Cause of the Child's Death?

Was the child's death due to (*a*) natural causes, (*b*) violence, or (*c*) neglect or omission.

(*a*) Death of Infant from Natural Causes.

Children are frequently born dead from natural causes. Still-birth is more frequent (*a*) in first than in subsequent pregnancies, (*b*) in male than in female children, and (*c*) among illegitimate than among legitimate children.

Statistics show the proportion of still to live births to be about $5\frac{1}{4}$ per cent. of the total number of births, and to be (*a*) about 9 per cent. in first as compared with about 3·2 per cent. in other pregnancies; (*b*) about 5·8 per cent. in male as compared with about 4·7 per cent. in female children; (*c*) about twice as great among illegitimate as among legitimate children.

Death from natural causes may be due to:

1. **Immaturity and consequent debility.**—When a child is born alive, and dies after its birth, solely in consequence of debility arising from its want of maturity, the question arises, Was the premature delivery, as a result of which the child was born immature, criminally induced or not? If criminally induced, an offence has obviously been committed. By the law of India, however, this offence is not punishable as culpable homicide.[1]

On the other hand, according to the law of England, provided, of course, the child lived after its complete birth, the offence which has been committed is murder.[2]

2. **Debility not due to immaturity.**—A mature infant free from disease, may die from debility, and consequent inability

[1] See *Penal Code*, *s.* 315.
[2] See case of *R.* v. *West*, Taylor, *Med. Jur.*, II. p. 318.

to continue breathing. In such a case the lungs will most probably be found, at any rate in parts, imperfectly distended and portions may be found in a condition of atelectasis (see p. 336).

3. **Disease.**—This may be **general disease**, *e.g.* small-pox, syphilis, or cancer: or **local disease.** If the latter, the seat of the disease may be the lungs, brain, or heart.

1. **Congenital disease of lungs.**—This, according to Guy, may be (*a*) hepatization—red or grey—from pneumonia before birth, or "white" or syphilitic, which is common; (*b*) pulmonary apoplexy; (*c*) tubercle; (*d*) œdema; or (*e*) Devergie's œdema lardaciforme.

2. **Disease of brain** and cord may be (*a*) morbid softening, "but it must be borne in mind that the brain of the fœtus is naturally soft and vascular"; [1] (*b*) effusion of blood (apoplexy) into the substance, cavities, or on to the surface of the brain; or (*d*) effusion of other fluids, *e.g.* serum or pus.

3. **Disease of the heart** or large vessels is rare in infancy. Tidy also mentions uric acid infarction, *i.e.* blocking of the kidney tubes with uric acid or urates, as a cause of infant mortality.

Obviously *post mortem* evidence of the existence of disease does not necessarily prove death therefrom; much must depend on the extent of the diseased condition.

4. **Malformation.**—Death may be due to a congenital malformation, *e.g.* of heart or large vessels; or of the alimentary canal, such as an imperforate gullet or anus; or of diaphragm causing hernia (Powell reports three such cases). No amount of malformation or monstrosity justifies the destruction of the infant.

5. **Haemorrhage from apertures of the body** may cause death, *e.g.* from the genitals of a female infant, or from the rectum. Two such cases are recorded by Casper.

6. **Protracted or complex labour** frequently results in the death of the infant. The immediate cause of death may be—

1. **Accidental violence** to the body of the child (see p. 341).

2. **Exhaustion from protracted labour.**—Death from this cause is frequently accompanied by marks of violence on the body of the child, especially on the head, but may not be so accompanied. Protracted labour is more common in first than in subsequent deliveries; and the greater the disproportion between the size of the child and that of the mother's pelvis, the more likely is labour to be protracted. Male children are generally larger than female children: hence more male than female children die during delivery.

3. **Foetal asphyxia.**—Asphyxia may occur before birth, owing to premature separation of the placenta, or be due to (*a*) the death of the mother, or (*b*) obstruction to the flow of blood through the cord. With reference to (*a*), Tidy remarks that there is more chance of saving the

[1] Guy, *For. Med.*, p. 114.

child when the mother has died suddenly, than when her death has occurred slowly. Garezky concludes that in most cases infants are more or less asphyxiated after the first minute, but that they may be extracted alive in a more or less asphyxiated condition, up to twenty-six minutes after the death of the mother. Harris considers that a child may live still longer (one to two hours). From Tidy's summary of 379 cases of *post mortem* Cæsarean section, it appears that in 81·3 per cent. of the cases the children were dead when extracted, and in 9 per cent. distinctly alive, but of these only one-seventh lived for any length of time. As regards (*b*), the obstruction to the flow of blood may be due to pressure on the cord from abnormal presentation, *e.g.* foot or breech, or from prolapse of the cord. Scanzoni gives nearly 55 per cent. as the mortality in cases of prolapse of the cord. Again the obstruction may be due to the accidental formation of a tightly drawn knot on the cord: two knots even have been found; and, lastly, the obstruction may arise from spontaneous rupture of the cord during delivery.

(*b*) Death from Violence.

Death from violence may be the result of accident, or the violence may have been inflicted intentionally; if the latter, under Indian law, it will be a material question whether or no death resulted from an act done before the birth of the child. Again, death from violence may be due to mechanical violence, or to poison; in the former case, the mode of death may be asphyxia, from suffocation, drowning, or strangulation; or coma, from head injury; or syncope.

1. **Asphyxia from suffocation.**—Accidental suffocation may occur in many ways, *e.g.* from the head being born enveloped in the membranes; from pressure of the child's face against soft bedding; from the child being overlaid by some one in the same bed; or from accidental entry of particles of food into the air-passages: Intentional suffocation is a frequent mode of infanticide. The following are the more commonly adopted methods:—

(1) Drawing the membranes tightly over the child's head; (2) closure of the mouth and nostrils by the hand or a cloth; (3) stuffing mud or rags into the mouth, or plugging the fauces with a piece of cotton-wool, sometimes, in India, smeared with mustard oil; (4) rolling the tongue back into the throat; (5) burying the child's face in bran, or in mud, cow-dung, or other matters. Any matters found in the throat of the infant should be carefully examined and preserved.

2. **Asphyxia from drowning.**—Accidental drowning (or suffocation) may occur from the infant falling into a privy or cesspool, owing to the mother being suddenly delivered while in the act of defæcation: this may occur even in primiparæ. Finding the cord torn across,[1] not cut, supports the supposition

[1] Usually about two inches from the navel (Guy).

of the occurrence of such an accident. Accidental drowning may also occur from the infant at the time of delivery falling face downwards into the mother's discharges. Intentional drowning is sometimes resorted to. In some parts of India, immersion of the child's face in milk is a common method of infanticide.

3. **Asphyxia from strangulation.**—Accidental strangulation may occur from the funis becoming tightly coiled round the neck of the child. Intentional strangulation, by the fingers, funis, or other ligature, is a frequent form of infanticide. As before mentioned (see 'Hanging and Strangulation'), if the ligature employed is a soft one, *e.g.* the funis, no marks may be left on the neck. Casper points out that natural folds on the skin of the neck, especially of fat infants, somewhat resemble marks caused by a ligature. Close examination and dissection of such marks, however, will show no extravasation and no condensation of tissue. If the *post mortem* appearances show that death has been due to asphyxia, much will depend on the absence or presence of marks indicating that the asphyxia has been due to violence. If all such marks are absent, death may have been the result either of accident or intention; it is not possible from the *post mortem* examination to say which. If such marks are present, much will depend on what they are. Some, of themselves, strongly indicate intention, *e.g.* finger-marks on the throat, or rags, etc., firmly impacted in the fauces. Others are consistent with either accident or intention, the probabilities being more in favour of intention than accident, if the amount of violence has been great. A torn cord supports the supposition of accident.

4. **Coma.**—Death from coma, due to head injury, may occur before labour, during labour, or after delivery. Here it is highly important to note that *the 'Caput succedaneum' is generally a bruise, and after death presents in most cases the appearances of a bruise.* On this point Professor Powell notes, "I am afraid that many a false charge of infanticide has been brought through practitioners not recognizing this fact, chiefly owing to *the false teaching of text-books* that the Caput is a 'serous effusion.'"

1. **Before labour.**—In very exceptional cases fracture of the skull of the fœtus in utero has been caused by violence applied to the body of the mother. Thus, Ogston (p. 286) mentions a case where a fracture of the right parietal bone, one inch in length, resulted from the mother, during a fit of hysteria, falling out of bed four weeks before delivery (see also

Case below). Great violence may, however, be applied to the body of the mother without injury to the fœtus.

2. **During labour.**—Pressure on the head from expulsive efforts during delivery may cause death from coma, either without or with fracture of the skull. The first, and much the most common case (without fracture), is the most frequent cause of death during delivery. In such cases, inside the cranium will be found congestion of the brain and its membranes, and in rare cases extravasation of blood. Outside the cranium a serosanguinolent tumour (*caput succedaneum* or *cephalhæmatoma*) frequently forms. Extravasations of blood under the scalp, due to pressure on the head, are, it should be noted, larger in size and more irregular in outline than the punctiform ecchymoses which occur under the scalp in cases of suffocation (see *ante*, p. 229). Injury to the head may be the result of efforts to effect delivery.—If the result of the mother's own efforts, the skull is not likely to be more than slightly fractured. Extensive injury may obviously be produced by the use of instruments; and considerable injury may be produced without the use of instruments, by ignorant efforts to aid delivery (see following *Case*).

Case.—**Fracture of an infant's skull** from attempts to aid delivery.—Dr. Hicks was called by a midwife to aid the delivery of a woman. On examination he observed that the skull was fractured through the parietal bone one side, and there was a slight fracture of the edge of the occipital bone, with a scalp tumour. The head of the child was at the brim of the pelvis, and the fractures had been produced by the midwife in her attempts to push the head back into the cavity.—Taylor, *Med. Jur.*, II. p. 404.

3. **After delivery.**—If a woman is delivered in an erect position, and the child falls on a hard floor, fatal injury to the head, with or without fracture to the skull, may occur. The possibility of this is shown (*a*) by the fact that several cases of this accident have been recorded (see Taylor, II. 390); and (*b*) by Casper's experiments on the bodies of infants, which conclusively prove that a fall from a height of 30 inches suffices to cause fracture of the skull. In every one of Casper's experiments, twenty-four in number, fracture was actually produced, confined, however, to the temporal bones in twenty-two out of the twenty-four cases. As before noted, sudden delivery, leading possibly to such an accident, may occur even in primiparæ (see following *Case*).

Case.—**Sudden delivery in a primipara.**—M.C., *æt.* twenty-three, single, was suddenly delivered of a full-grown male child at 5.30 A.M. She stated that between 4 and 5 A.M. she felt griping pains. She suspected that her labour was coming on, and walked to a friend's house 600 yards distant to be confined. When she had proceeded half-way, she was suddenly delivered while in the erect position, and her child fell upon the pavement. The naval-string was ruptured transversely 4 inches from the navel, and the placenta was expelled. She walked to the place where she intended to be confined, carrying the child, which she had wrapped in a petticoat. This was her first child; it was well-nourished and healthy looking. The only injury it had sustained by the fall was on the left parietal bone at the junction with the coronal suture; there was here a soft tumour between 2 and 3 inches in its transverse diameter, which was slightly ecchymosed. Both mother and child did well, and the tumour entirely disappeared at the end of three weeks. The cord was tied after the woman's arrival at the house. Taylor, *Med. Jur.*, II. p. 399, from *Lancet*, I., 1854, p. 637.

Finding the cord torn across supports the supposition that such an accident has occurred. The average length of the cord is eighteen to twenty inches; it, however, has been found as short as four to six, and as long as fifty-four inches. Intentional violence to the head is a common mode of infanticide. In homicidal cases the amount of violence employed is usually very great. On the whole, therefore, if death has resulted from injury to the head, and there is no fracture or punctured wound of the skull, it is almost certain that death was due to accident. Slight fractures of the skull bones are also perfectly consistent with accident. Extensive injury to the head is strongly in favour of homicide, especially if accompanied by a cut cord, and unaccompanied by severe injury to the mother.

5. **Syncope or shock.**—This may occur from (1) Hæmorrhage from the divided cord; (2) External wounds; (3) Fractures or other internal injuries.

(1) **Haemorrhage** from the divided cord is more likely to occur (*a*) when is has been cut across with a sharp instrument, than when it has been divided with a blunt one or torn asunder; (*b*) when it has been divided close to the umbilicus; (*c*) when it has been divided almost immediately after birth; and (*d*) when it is thick and gelatinous. Fatal hæmorrhage from the cord may possibly but not necessarily occur:—(*a*) If the cord has not been tied, and may occur even if the cord has been torn and not cut. Spontaneous rupture of the cord may occur during delivery; the usual mode of death from this accident is, however, asphyxia, not syncope. (*b*) From the ligature not being tied sufficiently tight, or from its slipping; or (*c*) From the navel after separation of the cord (secondary hæmorrhage). Obviously, when the cause of death is primary hæmorrhage from the divided cord, it is important to note (*a*) whether or not the free end of the cord appears to have been cut, and (*b*) whether or not a mark of ligature is present.

(2) **External wounds.**—Death from syncope or shock, the result of external wounds, is usually homicidal. Fatal external wounds may, however, be the result of accident, *e.g.* from broken utensils, or the result of an obstetric operation. The nature of the injury may show whether it is the result of accident or design. Fatal injury, it may be noted, may be caused by wounds which leave hardly any external mark, *e.g.* the thrusting of a needle through the fontanelles, the temples, under the upper eyelid and through the orbital plate of the frontal bone or through the back of the neck into the spinal cord or brain, or the thrusting of a sharp instrument down the throat or up the rectum. Cases have occurred of the employment of each of these methods. Such injuries obviously strongly indicate homicide; but Ogston,[1] it should be mentioned, records a case of death from accidental thrusting of a small pin through the anterior fontanelle.

(3) **Fractures or other internal injuries.**—Just as fracture of the skull may occur before, during, or after delivery, so fractures of other bones, or dislocations of joints, may similarly occur. Cases even are recorded of women, who have met with no accident during pregnancy, being, after an easy labour, delivered of an infant with more than one of its long bones fractured or dislocated. Fractures or dislocations are not likely to prove immediately fatal, unless the neck be the seat of the

[1] Lect. on *Med. Jur.*, p. 268.

injury. Twisting the neck is a frequently employed method of infanticide. Very great force is required to effect this, and hence death from this cause strongly indicates homicide. In one case a woman in her unaided efforts to effect her own delivery, the case being one of breech presentation, employed so great an amount of force, apparently without homicidal intent, as to tear the body of a child completely away from its head.[1]

6. **Infanticide by poison.**—In India poisoning by **opium** is said to be a commonly employed method of infanticide; and it is alleged that in some cases a peculiar mode of administration is adopted, viz., smearing the mother's nipples with the drug. Opium is largely used (in India as crude opium, and in Europe in the form of syrups containing opium) by women of the lower classes and by nurses (*ayahs*) to keep young children quiet. Hence accidental cases of the poisoning of young children by opium are of common occurrence. Other poisons said to be used in India for the purposes of infanticide are arsenic, tobacco and '*madār*' (*Calotropis sp.*), see 'Poisons.'

Taylor mentions cases of intentional poisoning of young children by arsenic, sulphuric acid, and phosphorus scraped from the heads of lucifer matches. Accidental poisoning of young children by arsenic has been known to occur, as, for example, in a recent case in England,[2] where a number were poisoned by the external application of arsenious oxide, introduced as an adulterant into 'violet powder.' It must not be forgotten that in new-born infants, *post mortem* appearances simulating those of irritant poisoning are sometimes met with as the result of disease, *e.g.* injection of the mucous membrane of the œsophagus, and ulceration of that of the stomach and intestines. Such appearances have been met with in the bodies of plump and fat children.[3]

(*c*) Death from Neglect or Omission.

Omission or neglect may be culpable.—Section 32 of the Indian Penal Code states: "In every part of this code, except where a contrary intention appears from the context, words which refer to acts done extend also to illegal omissions." Death from neglect or omission may be accidental or intentional, and causing death by an intentional and illegal omission may or may not amount to murder. The principal forms of neglect or omission likely to cause death are—

1. **Omission to provide assistance during labour.**—This may result in the death of the infant from suffocation, head injury from a fall, hæmorrhage from a ruptured cord, etc., etc. (see 'Death from Violence'). Two questions which may arise

[1] *Beng. Med. Leg. Rep.*, 1870–7, p. 314.
[2] See 'Arsenic,' Chap. XXIV.
[3] Ogston's *Lect., Med. Jur.*, p. 272.

in such cases are: (1) Is it possible for a pregnant woman to remain ignorant of her state up to the time of her delivery? That this, in exceptional cases, is possible, has already been pointed out (see 'Pregnancy,' p. 275); and (2) Would a newly delivered woman be capable of the exertion necessary to save the life of her child? As regards this second question, it may be remarked (*a*) that in rare cases women have been delivered during profound natural sleep (see *Case* below); and (*b*), that in some cases women have been known to go through a considerable amount of exertion immediately after delivery (see following case). As a rule, however, a newly delivered woman is capable of but little exertion.

Case.—**Unconscious delivery during sleep in a primipara.**—Dr. W. Case, of Chicago, attended a primipara whose delivery took place during profound sleep. During the day on which delivery took place she had been feeling unwell, but attributed this to over-fatigue on the previous day. Delivery took place rapidly, and the woman after it was complete, woke up in a fright, having dreamt that something was the matter with her.—Chevers, *Med. Jur.*, p. 767.

Case.—**Extraordinary exertion immediately after delivery.**—A woman, aged 40, a servant in a Bengali household, was delivered unassisted in an erect posture, of a mature child in the privy of her employer's house at 11 A.M. on the 6th February, 1893. She was doing her duties up to the time of going to that outhouse, and she lost much blood. The placenta came away in about an hour. She wrapped the child in rags and placed it on a shelf in the privy (according to her statement the child died from its head being knocked against the cement floor). After leaving the privy she went about as usual. At 2 P.M. she walked to Howrah station, about 2 miles. She started by the 10 P.M. train, made a journey of 97 miles sitting upright on a bench. After leaving the train she walked 26 miles in 3 days, subsisting on *muri*, or fried rice. On the 10th she was captured by the police and brought back to Calcutta. She was admitted to the Eden Hospital on the 12th and examined by Dr. Das. He found her rather weak; all the organs healthy, the signs of recent delivery were present. The woman was charged with infanticide and concealment of birth, and was convicted on the latter charge.—Dr. Kedurnath Das, *Ind. Med. Gaz.*, May, 1894.

Case.—**Exertion after delivery.**—A Brahman widow, after walking two miles, was delivered of a mature male child, and leaving it in the dry bed of a stream, walked back to the house from which she had started. She was tried for exposing her infant, and the judge held that the facts of the case were inconsistent with her defence, viz. that she was in bad health at the time, and from bewilderment and pain was unaware of what she was doing.—Chevers, *Med. Jur.*, p. 745.

2. **Omission to tie the cord after dividing it.**—If a woman has been delivered without assistance, proof that the cord has been cut, not torn, indicates that ability existed after delivery for a certain amount of exertion. This, taken with the other circumstances of the case, might support the supposition that the omission to tie was intentional. Previous to examining the cut end of the cord, this, if dry, should be softened

in warm water. A clean smooth edge indicates that the cord has been cut; a ragged edge may be the result of division with a blunt instrument or rupture.

Chevers gives the following description of the manner in which the umbilical cord is divided and dressed by native women in this country. In many parts the cord is not divided until after the placenta, or after-birth, has come away. It is only tied with one ligature, near the child, and, before tying, the blood is either pressed towards the child or towards the placenta, according as the child seems lively or otherwise. The cord is generally divided by a piece of bamboo, and a fact of the cord being found with jagged edges is therefore no proof of neglect. In order to induce the mother to bring forth the after-birth, it is usual to put some hair into her mouth. This causes her to try and vomit, and the effort brings away the placenta. It is also usual to observe certain religious ceremonies before cutting the cord.

3. **Omission to supply** the infant with food or to protect its body against cold may cause its death.—In the first case, absence of all signs of the presence of food in the alimentary canal may, it is possible, indicate the cause of death. In the second case, there may be no distinctive *post mortem* appearances present. Sometimes this omission takes the form of 'abandonment' of the infant. This is an offence, even if death does not result, for by *s.* 317 of the Indian Penal Code, "Whoever being the father or mother of a child under the age of twelve years, or having the care of such child, shall expose or leave such child in any place with the intention of wholly abandoning such child, shall be punished with imprisonment of either description for a term which may extend to seven years, or with fine, or with both." For a curious legal point arising under this section, see *Case* below, *R.* v. *Beejoo.*

Case.—**Alleged abandonment of an infant.**—In this case the following facts arose: A, the mother of a newly born child, being herself too ill to move, sent B to expose it. It was held by Scotland, C.J., that A could not be convicted under this section (*s.* 317) as she had not actually exposed the child, nor B as she was not the mother. Also, that neither A nor B could be indicted for abetting the other, since as neither could have committed the offence there could be no abetment by the other. Of course, a person who has the custody of a child merely for the purpose of exposing it, cannot be indicted as a person "having the care of such child."—*R.* v. *Beejoo*, 1st Mad. Sess., 1869, Mayne's *Penal Code*, p. 275.

Lastly, by *s.* 318 of the Indian Penal Code, it is an offence "by secretly burying or otherwise disposing of the dead body of a child, whether such child die before, or after, or during its birth," to intentionally endeavour to conceal "the birth of such child." Women are frequently convicted under this section when the evidence fails to support a graver charge.

Examination of the Alleged Mother.

SIGNS OF DELIVERY.

The signs of previous delivery, in cases where the signs of recent delivery are absent, have already been discussed (see p. 296). The question may, therefore, now be limited to recent delivery. Does this woman exhibit signs of having been recently delivered of a child? On examination during life of a woman who has recently been delivered of a mature, or nearly mature, child, the following signs will usually be found:—

1. **A general appearance of indisposition.**—This, however, may be present in women, who have not been recently delivered, as the result of any severe illness. Again, this sign may be absent in women who have been recently delivered. Some women, especially those accustomed to labour, appear to be constitutionally but little affected by delivery, and are capable immediately afterwards of resuming their work or undergoing severe exertion. Chevers,[1] on the authority of Ward, states that poor women in the northern parts of Bengal are known to attend to the business of their families the day after delivery; and that sometimes a mother is delivered while at work in a field, carries home the child, and returns there to work the next day. For an instance of very considerable exertion directly after delivery, see *Case*, p. 346.

2. **Organs of generation swollen, contused, or even lacerated.**—A laceration of the fourchette is usually found after delivery in primiparæ. The os uteri may also be found lacerated, and is dilated and soft. The uterus is enlarged; and Ogston[2] remarks, may for the first two or three days be found to undergo alternate contraction and relaxation under pressure of the hand applied to the abdomen. The abdominal parietes are relaxed, the lineæ albicantes apparent, and a dark line is seen extending from the pubes to the navel.

3. **Breasts,** as in advanced pregnancy, are full and prominent, and the nipples surrounded by well-marked areolæ. Milk will be found exuding from the nipples.

4. **Lochial discharge.**—The presence of this discharge is the most characteristic sign of recent delivery. It is at first coloured with blood, afterwards become brown or green, and has a peculiar odour. The discharge may become almost

[1] *Med. Jur.*, p. 774. [2] *Lect. Med. Jur.*, p. 155.

wholly suppressed about the third or fourth day under the influence of the milk fever, returning when this has subsided. It usually lasts a week to a fortnight, but may continue longer. Ogston[1] states that in some instances the lochia have been known not to appear at all.

Many of these signs may be present as the result, not of delivery, but of uterine or ovarian disease. No conclusion can, therefore, be safely drawn, unless all, or nearly all, the signs of recent delivery be present. As a rule, the signs of recent delivery cease to be distinguishable after the eighth to the tenth day; and the stronger the woman, and the less severe the labour, the more likely are they to disappear rapidly. The earlier the period of gestation also, at which delivery has taken place, the less marked will be these signs and the more quickly will they disappear. For further signs of recent delivery ascertainable on *post mortem* examination, see 'Causing Miscarriage,' p. 322.

[1] *Lect. Med. Jur.*, p. 158.

CHAPTER XVII.

UNNATURAL SEXUAL OFFENCES.

THE desire for unnatural sexual intercourse, so repugnant to the normal mind, may be acquired, or it may be due to perverted sexual instincts in which a man may be psychically a woman and *vice versâ*. Even in the acquired sodomy which is so prevalent in the East, it is probable that there may often be some slight abnormality of sexual passion present, since many men who have given themselves up to the most unbridled debauchery never develop any tendency to unnatural intercourse. An unnatural offence is defined by *s.* 377 of the I. P. Code to be "carnal intercourse against the order of nature with any man, woman, or animal," and, like in rape, "penetration is sufficient to constitute the carnal intercourse necessary to the offence."

The law of England on this subject is as follows:—"Whosoever shall be convicted of the abominable crime of buggery, committed either with mankind or with any animal, shall be liable," etc., etc. (24 & 25 Vict., c. 100, s. 61). Further, from a decision in England, it would appear that to constitute the crime of "buggery with mankind" the penetration must be anal; introduction into the mouth was held not to constitute the offence. Whether introduction into the anus is necessary to constitute the "carnal intercourse with any man or woman," contemplated by s. 337 of the I. P. Code, does not appear to have as yet been decided.

Three forms of unnatural sexual intercourse are usually described, namely, (1) Sodomy or sexual intercourse between two human beings usually of the male sex (the converse form, Tribadism or sexual congress between two human beings of the female sex is not publicly known); (2) Pæderastia or that form of sodomy in which the passive agent is a boy, a *catamite;* and (3) Bestiality, or sexual intercourse of mankind with the lower animals.

Sodomy.—This offence is largely practised in many countries, and is extensively practised in India. Indeed, Chevers mentions a case where two men, convicted of this crime on their own confession, defended themselves by putting

forward the plea that "it was their occupation."[1] The offence is not uncommon in prisons, and it is a well-known prison rule that where more than one prisoner is confined in one cell, the number should never be less than three.

Sometimes the offence is practised between two men, either taking alternately the part of active and passive agent. In other forms of the offence, the passive agent is a boy, and in others, again, a eunuch. In the course of a trial at Mainpuri in 1852, it came out that a great number of eunuchs regularly practising the offence exist in India; these go by the name of '*hijrahs*,'[2] dress as women, and profess to obtain their living by dancing and singing at births and marriages. They recruit their ranks by castrating boys;[3] as a rule making a clean sweep[4] of the whole of the genital organs. (See also Injuries of the Male Genitals, p. 139.)

In India as in Europe false charges of sodomy are sometimes made for purposes of extortion. Where the act has been done with consent the law regards the active and passive agent as equally guilty. In England, however, if one of the two is over and the other under fourteen, the one over fourteen alone is charged. In India the question of age in relation to responsibility for this offence is governed by the general exceptions of the Penal Code (*ss.* 82 and 83). As in the case of rape, the question of alleged capacity or the active agent may form part of the inquiry, or whether feeble minded.

Signs of Sodomy.—1. **Habitual practise** of the offence.—Male adults who habitually practise sodomy often affect effeminate manners, dress like women, etc.; and, as already pointed out, the passive agents in India are frequently eunuchs.

Case.—A Brahman, aged about 40, sought treatment for a boil on the perinæum. On examining the 'boil,' I found it to be a typical Hunterian chancre, situated one inch in front of the anus, and on being questioned, the patient admitted that he might have contracted it from one of his friends. He volunteered the statement that he had been a pathic for at least twenty years, so I examined him for the classical signs of his aberration, and found none of these. The genitals were well formed, there was no deformation of the anal region, no infundibulum or loss of rugæ, and the tone of the sphincter was normal.—Sutherland, *Ind. Med. Gaz.*, 1902, p. 246.

The presence of a chancre about the anus, or of a gonorrhœal discharge from the rectum, is, of course, strong evidence that the individual has been the passive agent in the offence, and may be corroborative evidence of his having acted in that capacity.

2. **Recent commission** of the offence.—If it is alleged that the offence has been recently committed without consent, both

[1] *Med. Jur.*, p. 708.

[2] They are to be distinguished from the similarly mutilated eunuchs, *khwajas*, who guard the harems in palaces and are relatively more respectable in their habits.

[3] *Med. Jur.*, p. 707.

[4] *Ibid.*, p. 497.

parties should be examined for marks of violence indicative of a struggle, as in a case of alleged rape; and whether the act has been done with consent or not, the alleged active agent should be examined in the same way as the accused in a rape case. Examination of the passive agent may show stains of blood, or seminal fluid or characteristic gonorrhœal discharge on his clothes or person in the neighbourhood of the part; or if the individual is a young boy or a person unaccustomed to the offence, there may be found about the anus bruising or excoriations of the mucous membrane, or, perhaps, slight laceration of the sphincter. Obviously, also, the question of the age of the parties must be considered, seeing that this bears on the question of their criminal responsibility.

Bestiality.

The form of this offence in which a human male is the active agent is tolerably frequently met with in India. Cases occur every year in which the offence is alleged to have been committed with a goat, a mare, an ass, a cow, and even a hen. In these cases, matters removed from the vagina of the animal with which the offence has been committed, or adhering to the surrounding hairs, may have to be examined for the presence of spermatozoa. Detached hairs may also be found adherent to the person or clothes of the accused, and may have to be examined as to the identity or otherwise of their appearance, with the hairs of the animal employed as the passive agent.

CHAPTER XVIII.

INSANITY AND THE STATE.

Unsoundness of mind or Insanity is a disease or disorder. The general tendency of all mental disorders being to disturb the balance of social environment, it frequently expresses itself in the form of a crime. To guard against this the law places persons of unsound mind under restraint, and the medical jurist is chiefly concerned with the diagnosis and certifying of the fact of insanity.

An insane person is not held responsible for any crime he may commit, and insanity may be accepted as a reason for divorce or for contesting a will. The plea of insanity is sometimes set up dishonestly by the defence in criminal cases to try to escape from the prescribed punishment which would otherwise be imposed by law as a deterrent to sane persons of criminal tendencies—for the safety and security of society is the true object of all legal punishment. While there is thus a danger in too readily acknowledging the presence of insanity as an excuse for crime, the plea of insanity might perhaps, in the interests of society, be set up oftener, as the most serious criminal, the congenital or instinctive criminal, is morally insane, and the community would be better protected against an insane criminal by his permanent incarceration in an asylum than by his being sentenced to a term of imprisonment, after which he is set at large again.

According to modern psychologists all crime is due to a latent or active neurosis or physical defect or degeneration of the brain (but see p. 21).

Prevalence.—A false impression of relatively low prevalence of insanity in India is apt to be gained by comparing the Indian official statistics of insanity with those of Europe. In the latter case the greater number of positive insanes are registered and confined in asylums; whereas in India only a relatively small proportion are so confined or registered, and these largely of the more dangerous criminal class. No doubt the lower state of civilization of the Indian masses would imply

a somewhat lower percentage of insanes. For, as has been well expressed by Professor Powell, "Insanity being chiefly exhibited by inability to live up to the dictates of the society to which the individual belongs, it is natural that the higher the standard of civilization, the greater the number of individuals who fall short of the standard. With a lower standard, the number unable to pass becomes less, and in a savage community there are nominally no lunatics." The census of 1901 revealed a proportion of only two insane persons for every 10,000 of the population as against about an average of 33 for the corresponding population in England. But, not only are very many cases of insanity concealed, especially among women—the stigma of family insanity being no less acutely felt in the Orient than in the Occident—the Indian figures are fallacious, in that many idiots, chiefly cretins and deaf mutes, all persons who are weak-minded and all those whose insanity is adjudged by the uneducated enumerator or by the friends to be of a temporary character, are rigidly excluded. All these persons would be returned as insane in England; the statistics of the two countries are, therefore, not comparable. In further proof of this, reference may be made to the special investigation of 327 deaf mutes, none of whom had been returned as also insane at the census; yet no fewer than 153 of these were found to be mentally defective to a greater or less degree. The number of deaf mutes in India is very great, viz. 153,168, and it is probable that more than half of these are also insane. Besides, there is an enormous class of religious mendicants, sadhus, and fakirs—non-existent in Europe—the majority of whom are certifiably insane, and *many of whom are very dangerous insanes*, although they are permitted, in virtue of the superstitious reverence in which they are held by the masses, to roam about. The relation of these vagabond ascetics to the prevalence of crime and insanity in India is as important as it is interesting, as we shall find.

The majority of Indian insanes are detained and cared for in their own homes. Of the total number enumerated in 1901, viz. 22,941, only about a fourth were lodged in asylums. Nearly 25 per cent. of the asylum population in India are criminals, while only 20 per cent. are women. This sexual proportion of the insanes in India is in marked contrast to that in London, where the annual report of the Metropolitan Asylums Board for 1918 gives the numbers of males as 2393 and females as 3135. The explanation of the Indian figures is probably owing to the seclusion of women.

Causes.—The causes of insanity may be broadly classed as physical and moral. It should be remembered, however, that

in nearly every case of insanity there is more than one factor, either predisposing to or actually exciting the condition.

Physical.—In many cases of insanity there is an obvious defect in the nerve centres of the brain to account for that impairment or derangement of the brain which we call insanity. But in others the defect, if present, is not apparent to the pathologist. The chief physical causes are :—

1. **Congenital defects in constitution.**—This may show itself as arrest of development occurring before or soon after birth, giving rise to amentia (p. 358). In such cases there may or may not be visible head deformity. The arrest of development may be due to changes interfering with the growth of the skull bones, as in cretinism (p. 361). Hereditary insanity may come under this head. At Berhampore, Bengal, among 575 male patients treated during 1907, in 46 a definite history of hereditary or family tendency to insanity was obtained ; but it should be observed that the records of most of the patients are imperfect, and it is not possible to trace their antecedents.

2. **Injury or disease.**—Epilepsy, injury to the head, and sunstroke may all give rise to insanity. Bucknil and Tuke estimate that epilepsy is the cause of about 6 per cent. of the admissions for insanity into asylums. In 28 out of 575 male insanes treated at Berhampore in 1907 the insanity was due to epilepsy, cases of congenital defect combined with epilepsy being, of course, excluded. Wasting diseases, *e.g.* tuberculosis, specific fevers, uterine and ovarian disorders may give rise to insanity. Pregnancy is sometimes accompanied by insanity, the patient often recovering after delivery. Insanity has also been traced to the changes of puberty, to the onset of senility, and to the effects of the menopause. Intestinal irritation, a toxic factor probably, has also caused insanity.

3. **Intoxication by the use of drugs, such as Indian hemp and alcohol.**—In 1907, out of 5474 insanes in Indian asylums, in 602 the insanity was ascribed to hemp drugs, in 135 to alcohol, and in only 31 to opium. The smoking of Indian hemp, either as *ganja bhang* or *charas*,[1] is the most common cause of insanity in India. Of 575 male insanes at Berhampore in 1907, 51 were cases definitely due to previous indulgence in ganja, and in a number of other cases there was a probability of this factor having had greater or less effect. Popularly speaking, the effect of hemp drugs in the causation

[1] See for Ganja, etc., p. 369.

of insanity in India has been overrated, while, on the other hand, it was distinctly underestimated by the Hemp Drugs Commission of 1894. As Major G. Ewens has shown,[1] about 20 per cent. of the insanity among males can be attributed to the abuse of hemp drugs.

Alcohol, such a common cause and such a potent contributory factor to insanity in Europe, is not so in India, where spirit drinking, as has been stated above, is not common. Opium is an uncommon cause of insanity.

4. **Shell-shock.**—Since the Great War, shell-shock, which often induces a condition bordering on insanity, has been alleged as an excuse for crime, and accepted as such by Courts of Justice. The shell-shock neurasthenic is subject more or less to moods of depression and irritation, which may occasionally result in crime.

Moral.—Moral causes are grief, domestic trouble, religious anxiety or excitement, and mental overwork. In India, in 1906, out of 2777 insanes in whom the cause was shown, in 776, or nearly 30 per cent., the cause was of a moral character, chiefly grief or religion.

General signs—Delusions.—The disordered mind in insanity may be the subject of delusions or hallucinations, though the absence of either of these in undoubted cases of insanity is not uncommon. A 'delusion' is a perversion of the judgment whereby the individual accepts as real an erroneous perception or conception which has no real existence; hence a delusion, if not removable by the presentation of facts and powers of reason, is evidence of a disordered intellect. The delusions of an insane person concern his own personality. **'Illusion,'** on the other hand, is merely a false perception by the senses of an external impulse. It is objective with no disorder of the reasoning faculty; for the affected individual on closer inspection perceives that he has been the subject of a false impression. Illusions are mostly visual, but may affect other senses, such as hearing and smell. A common instance is when in a dimly lit room a person supposes he sees the figure of a man, but on closer inspection finds it is only a suspended coat. The spectacular display of 'Pepper's ghost' is an illusion. **Hallucination** is differentiated from a delusion, in that it is an erroneous perception without an external impulse. It may affect more than one of the senses. If it be rejected by the reasoning faculties there is no insanity; but if accepted by

[1] *Ind. Med. Gaz.*, November, 1904, and *Insanity in India*, 128, etc., 1908.

them, a delusion results. Hallucinations of hearing are the most common in insanity, the person hears voices speaking to him when there is absolute silence. In *delirium tremens* there are hallucinations of sight.

Forms of Insanity.

That group of disorders of the brain which is called 'insanity' comprises such varied conditions with overlapping symptoms that various classifications of an arbitrary kind have been proposed. In the present state of our knowledge any classification of insanity must necessarily be provisional. For medico-legal purposes, however, we may classify the various types of insanity as follows:—

I. *Amentia,* or '*Dementia naturalis,*' congenital insanity due to the arrest of development of the nerve-centres.
II. *Dementia proper,* or '*Dementia adventitia vel accidentalis,*' degenerative acquired imbecility, due to degeneration or failure of the nerve-centres.
III. *Acquired active insanity* from disorder of nerve-centres.

The chief forms within these groups may be roughly tabulated thus:—

Classification of Forms of Insanity.

- I. AMENTIA (congenital)
  - Complete, or Idiocy, including Cretinism.
  - Partial, or Imbecility.
- II. DEMENTIA (acquired)
  - Primary from masturbation, etc. (D. præcox).
  - Secondary, apoplectic and epileptic, syphilis, sunstroke,[1] etc.
  - Senile.
  - Paralytic, general paralysis of insane (G.P.I.).
- III. ACTIVE ACQUIRED INSANITY
  - INTELLECTUAL MANIA (delusional)
    - General and Partial
      - Toxic
      - Epileptic, etc.
      - Melancholia
    - Delirium of fever, puerperal, alcohol, hemp, etc., usually temporary.
    - Mania.
    - Monomania and hypochondria.
    - Hypnotism and somnambulism.
    - Stupor.
  - MORAL
    - General (unbridled depravity).
    - Partial
      - Kleptomania.
      - Incendiary.
      - Erotomania.
      - Dipsomania.
      - } Impulsive insanity.

[1] See acute primary dementia, p. 362.

I. Amentia.

In this form of insanity the individual is of unsound mind from birth. Hence amentia corresponds to what legal writers call '*dementia naturalis*,' or 'the fool natural.' Two forms of amentia are recognized by medical writers, namely, (1) Complete amentia, or idiocy; and (2) Partial amentia, or imbecility; and 'Cretinism' may be added as a third form.

(1) **Complete amentia, or idiocy.**—In this form of amentia the arrest of development not only affects the higher or intellectual nerve-centres, but appears also to affect the centres of sensorial perception. Hence, in the fully developed form of complete amentia, the individual carries on a mere vegetable existence, not having the sense even to eat or drink. In the more common and less developed form there is a certain amount of intelligence; the individual recognizes his friends, is capable with extreme difficulty of acquiring a certain amount of education, and is able to make his wants known by signs, or imperfectly articulated words. In almost all there is visible bodily deformity, the cranium is small, its vertex depressed, and the forehead retreating. The palate is narrow and unduly arched, the face seems to occupy the whole of the front part of the head, the expression is vacant, there is often squint, hare-lip, or other sign of non-development; many are deaf-mutes. Their habits are often disgusting, their sense of taste or smell being frequently defective; they eat or drink anything, filthy or not. Some pass their evacuations unconsciously.

(2) **Partial amentia, or imbecility.**—It is difficult to draw any precise line of demarcation between partial and complete amentia. In imbecility, however, there is not that marked want of development of the centres of sensorial perception which is present in idiocy. Guy and others regard possession of the faculty of speech as the character distinguishing imbecility from idiocy. Two forms of imbecility have been described, namely, (1) Intellectual imbecility, and (2) Moral imbecility.

Of the two, intellectual imbecility is the form which most closely approaches to idiocy in its characters, the affected individuals in well-marked cases only differing from those suffering from complete amentia in its less pronounced forms, in possessing the power of speech. Intellectual imbeciles, although markedly deficient in general intellectual power, are capable of acquiring an amount of education sufficient to fit them for carrying on duties requiring no great mental effort

(see *Cases* (*c*) and (*e*) below). In moral imbecility the defective development appears to affect chiefly the higher functions of the brain, the affected individual, although fairly intelligent and shrewd, being seemingly deficient in moral sense and in power of self-control (see *Cases* (*f*) and (*g*) below), his mental condition in some cases closely approaching to that present in moral mania. It may further be noted that in some cases of imbecility the individuals are greatly "under the dominion of childish fancies" approaching in character to delusions (see *Case* (*g*) below).

Imbeciles may commit such serious crimes as murder. In Eastern climes, where there are generally vagabonds liable to be abused and teased beyond endurance on account of their grotesque appearance or their foolish behaviour, they not infrequently retaliate on their aggressors. Of twenty-one imbeciles or idiots in the Berhampore Asylum who had been charged with various crimes, chiefly thefts, five had committed murders and two grievous assaults (see *Cases* (*a*) and (*b*) below).

Case (*a*).—**Imbecility** (high grade) with homicidal propensity.—B. B., a Hindu male, admitted to Berhampur Asylum in August, 1895. A congenital imbecile whose father was insane and whose brother committed suicide. A native of Birbhum. One day he went with his wife and child to cut wood and while employed thus he suddenly murdered them both without apparent motive or cause. A foolish-looking high-grade imbecile, fairly intellectual and capable of simple work. Can talk, but rarely does so. Memory very defective.—C. J. R. Milne, 1008.

Case (*b*).—**Imbecility** (low grade—without epilepsy).—Kali Lodha, admitted in 1904, at the age of 18 charged with theft. Some years previously had been convicted of theft and was then disowned by his relatives and became a vagabond thief. A smiling happy imbecile, with a fair amount of general intelligence. Childish in manner and behaviour. Speech limited to a few words. A very willing general help. Perfectly harmless. Has shown no thieving propensity since admission, probably because he has been well cared for, and his desires for food, clothing, etc., have been satisfied.—C. J. R. Milne, 1908.

Case (*c*).—**Intellectual imbecility.**—"A man of forty, of weak intellect from birth, but capable of such education as fitted him to be a copying clerk. He fell into bad company, committed theft, and was tried and acquitted on the ground of insanity. In general he is quiet, inoffensive, and taciturn, but answers simple questions rationally. He is subject to frequent attacks of excitement, preceded by shuffling of the feet. In these attacks, which last several days, he talks incoherently, is restless and will strike and kick those about him. When he was about thirty years old he shut the door of his room, placed a long form close to the fire, laid himself on the form, and his head on the grate. He was found insensible, but, on being removed to an open window, had copious bleeding from the nose, and soon came to his senses. His head was burnt to the bone."—Guy, *For. Med.*, p. 164.

Case (*d*).—**Intellectual imbecility.**—John Barclay was tried and executed at Glasgow, in 1883, for the murder of one Samuel Neilson. Barclay

had shown some affection for his victim, but killed him that he might possess himself of three one-pound notes and a watch, which he took from him. After the murder, Barclay hovered about almost without disguise, and while going to spend part of the money with the first person he met, dropped first one and then another note at his feet. When questioned, he could see no difference between killing a man and killing an ox, except that he "would never hear him fiddle again," and he looked on the watch as an animal, and when it stopped, thought it had died of cold from the glass being broken. In his parish he was known as "daft Jock Barclay," and the clergyman, who knew him well, "always regarded him as imbecile, and had never been able to give him any religious instruction, and did not consider him a responsible being."—Guy's *Factors of the Unsound Mind*, p. 173.

Case (*e*).—**Moral Imbecility.**—Cuthbert Carr gave himself up to the police, confessing to the murder of a female child, aged six. By his own voluntary and detailed confession he choked the child while he was having connection with her, to prevent her informing against him. He had been attacked with venereal disease, and his object of having connection with the child was to cure himself. After the murder he showed great shrewdness in the measures he adopted to avert suspicion. In his confession he stated that he knew doctors could not, or would not, cure the disease; that they did their best to protract a disease, and, when they could not protract it any longer, killed their patients; that they poisoned the wells in cholera time, etc., etc. Dr. Browne reported that he found him to be labouring under mental weakness or defect, probably congenital, and that his general appearance and manners were such as are usually associated with partial mental defect or eccentricity. That otherwise he was of fully average intelligence, expressing himself with accuracy and facility, that his powers of calculation and memory were unusually acute, and that he was perfectly capable of distinguishing between right and wrong. He was acquitted on the ground of insanity.—Browne's *Med. Jur. of Insanity*, p. 71.

Case (*f*).—**The Windham Case.**—In this case W. F. Windham was alleged to be of unsound mind and incapable of managing his affairs. It was proved that he had been sent to Eton, but that he had profited very little by the means of education which were placed in his power. He was wholly unlike other boys, and when he came of age, in 1861, his conduct was such as to lead to a belief in the minds of those who were acquainted with his position, that he was insane. It was further proved that he was utterly deficient in business capacity; that he was extravagant in purchasing articles which he did not require at exorbitant prices and in unnecessary quantities: that in consequence of such acts he incurred enormous debts, without having any reasonable prospect of being able to meet the demands when they became due; that he was guilty of gross indecency of language and conduct in public places, and that even the presence of ladies was not a restraint; that his appetite was voracious; that he associated constantly with people of the most indifferent character; that three weeks after he came of age he married a woman of disreputable character and life; that he married her knowing that up to the night previous to the marriage she had lived with one of his friends as his mistress; that having married her, he infected her with the venereal disease, and subsequently presented her with jewellery of the value of from £12,000 to £14,000, and settled £800 a year on her for life; that his income, at the time he did this, was not more then £1500 per annum. The evidence went further to show that although his wife,

subsequent to her marriage, cohabited with another man, Mr. Windham condoned this act by residing with her even after her adultery; that he was in the habit of acting as a railway guard, was careless as to personal cleanliness, and on occasion displayed an utter want of feeling. There was great conflict of medical testimony in this case, but the result was that the jury, by a majority, returned a verdict that Mr. Windham was of sound mind, and capable of taking care of himself and his affairs.—Browne, *ib.*, p. 67.

Case (*g*).—**Imbecile dominated** by a childish fancy.—"A young gentleman, aged twenty, was the slave of a childish fancy for windmills, with an aversion equally strong to water-mills. Having been placed under control in a place where there were no windmills, he cut the calves of a child's legs through to the bone, and stated that he would have taken away its life, that he might be tried for his act and removed from a place were there were no windmills. He had always been violent when thwarted in his fancy, had threatened his keepers and members of his family, and had more than once made preparations for committing murder."—Guy's *For. Med.*, p. 166.

To these may be added as a third form :—

(3) **Cretinism.**—This is the name given to a form of endemic idiocy prevalent in certain hill or sub-montane districts, and apparently the result of local conditions. It is met with in the Sub-Himalayas in India, and probably due to goitre in mother and dependent on developmental changes interfering with the growth of the skull bones. It is usually associated with atrophy of the thyroid gland in the individual or with goitre in his parents. The skin is usually coarse and dry.

Cretinism or **Infantile Myxoedema** is a condition brought about by absence or faulty development of the thyroid gland. It is endemic in association with goitre among adults, in certain hill districts and valleys, such as parts of Switzerland, Tirol, the Himalayas, and the Kassiya and Jaintia Hills. Sporadic cases also occur, generally as a result of atrophy of the thyroid following some specific fever.

Symptoms.—Toward the end of the first year of life it is noticed that the child is mentally dull, makes no effort to crawl, walk or speak, and takes no notice of its surroundings. It is then seen that the child has ceased to grow, that the skin is rough and dry, the hair dry and scanty. Later it is observed that the face is heavy, pasty and bloated, the nose flat, its alæ thick. The eyelids are heavy and puffy, the lips thick and pendulous; the tongue, large and swollen, hangs out of the mouth, allowing saliva to dribble, and gives the child a particularly fatuous expression.

Ossification and dentition are delayed, and the child grows

up an imbecile, pot-bellied dwarf with short, thick, and stumpy arms and legs.

Case.—**Cretinism.**—Hindu woman, aged 18. Height 28 inches. Looks like a pot-bellied baby two years old. Cannot stand without holding some object such as a chair. Imbecile, cannot speak. The only sound she utters is to gurgle "Goo-goo" occasionally. Never plays or takes interest in anything. Never signifies that she wants food. Defæcates and micturates without notice on her clothes or mat. Her face is fatuous and utterly devoid of expression. Her abdomen is pendulous so that the pubes are concealed when she is erect. Her calves and ankles are of the same diameter. Her breasts and pudenda are infantile. There is no hair on the pubes or in the axillæ. The hairs of the scalp are very sparse and do not exceed three inches in length though they have never been cut.

She was treated with thyroid extract, rather irregularly and intermittently, with considerable improvement, so that two years later her condition was—

Height 34 inches. She keeps her tongue inside her lips, which have become much thinner and are kept shut. She smiles quite amiably when any one she likes approaches. There is a difference of two inches between the circumference of the calf and the ankle. Her breasts have considerably enlarged. The hair of the scalp and eyebrows has become nearly normal in thickness. She walks but is lazy. Plays with toys, calls for food when hungry. She cries, smiles, gets angry or sulky on appropriate stimuli like children of four or five years of age. Is clean in her habits and is developing a little womanish vanity. She has a vocabulary of about a hundred words.—Professor Powell's *Reports*, 1917.

II. **Dementia.**

Legal writers use this term as synonymous with insanity, grouping all cases of mental alienation under the two heads of (1) *Dementia naturalis*, or 'the fool natural,' *i.e.* individuals insane from birth; and (2) *Dementia adventitia*, or *accidentalis*, *i.e.* an acquired imbecility—individuals who become insane after birth.[1]

In medicine the term *dementia* is employed to denote that form of insanity in which the mental powers, having attained maturity, subsequently fail, the individual falling into a condition more or less resembling amentia, but distinguished from amentia, by being the result of failure of power previously present, and not the result of original want of power. Dementia may be acute, that is, come on suddenly; or chronic, *i.e.* come on slowly; and may be secondary, *i.e.* follow on a previous attack of mental or other disease; or primary, *i.e.* come on unpreceded by any such attack. Occasionally dementia is both acute and primary.[2] Acute may follow a serious attack

[1] Guy, *For. Med.*, p. 166.

[2] In India acute primary dementia, always rare, is when met with generally a result of sunstroke.

of brain or other disease, *e.g.* typhoid and malarial, or cerebro-spinal fever, etc. Recovery may take place from acute dementia. The form known as *Dementia præcox*, which comes on soon after puberty, and whose exciting cause is often sexual, is not uncommon in India.

Usually dementia is chronic, and secondary to an attack of acute mania or melancholia, or it may supervene as the result of old age (senile dementia). When dementia comes on slowly, often the first symptom noticed is failure of memory. This is followed by general dulness of all the mental faculties. The bodily health is usually good. In very advanced cases the functions of the centres of sensorial perception become impaired —indeed, insensibility to pain is often noticed in the early stages—and the animal instincts even are lost. Recovery rarely, if ever, takes place from chronic dementia. Dementia may be accompanied by occasional attacks of maniacal excitement.

Case.—**Primary dementia (Dementia praecox).**—B. Ch. R., admitted into the Berhampore Asylum in January, 1901, from Krishnagar. Hindu male, aged 22 years. His father and his only sister were both insane. Until the age of 16 he is said to have been quite normal. He then became rapidly dull and stupid and fell into the state in which he has continued for six years. Condition on admission.—A dull, stupid-looking man of poor physique, with saliva dribbling from his mouth. Is extremely filthy. Will not speak and pays no attention to anything. After admission he improved somewhat for a time. He spoke occasionally, but only about his food. His appetite poor at first, then became voracious, and he was observed on more than one occasion to eat filth. He was absolutely shameless, masturbating frequently in public. For six years he continued to exist as a filthy dement with no thoughts but for food. In February, 1907, he was admitted into hospital suffering from Bright's disease, and he died of this a year later. —C. J. R. Milne, 1908.

Case.—**Secondary dementia (partial).**—*Bye*, or *Bhai*, admitted on December 21, 1866, from Backerganj, E. Bengal, in a state of noisy aggressive mania, which became chronic and which gradually led to his present state of dementia, in which he has remained for fifteen years. A childish vagabond with a very defective memory and devoid of intelligence. At times irritable if interfered with. Has a voracious appetite and is very indifferent to clothing.—C. J. R. Milne, 1908.

Case.—**Senile dementia.**—R. Ch. K., an old man of 70, a poor cultivator and labourer living with his family at Midnapore, was caught one day stealing eight bundles of paddy (rice) and was sent to the asylum, having been certified insane and incapable of trial. A poor old man, dazed and foolish; babbling incoherently, very dirty in his habits. Admitted in a state of physical debility, placed in hospital on admission suffering from heart disease. Died three months after admission.—C. J. R. Milne, 1908.

General paralysis of the insane.—This is the name given to a form of dementia, in which the failure of the power of the higher or intellectual nerve-centres is accompanied by failure

of power of the motor-centres. G. P. I. is more common among men than women. It frequently attacks men of education and position. Like tabes it is due to syphilis, in 60 to 70 per cent. giving a positive Wasserman reaction, but, as has been remarked, both general paralysis and tabes are rare amongst uncivilized or half-civilized races notwithstanding the frequency of syphilis.

Of 4200 Indian cases of insanity coming under Powell's observation in the past sixteen years, only three were G.P.I.

Case (*a*).—**G.P.I. in an Indian.**—F. M., aged 42, a Mahomedan fireman on a P. and O. mail steamer. Said he had syphilis twelve years previously. Wasserman positive. Knee jerks exaggerated. Pupils contracted, insensible to light, sluggish to accommodation.

He has many cheerful delusions of greatness, *e.g.*: He says he has bought all the estates of Tippu Sultan and is Emperor of Calcutta. He has bought land worth five crores from "Boku Babu" and made him his Assistant Jemadar. He promised me two cheques of fifty lakhs each, and handed me two ship's bar "chits." He says he is a Judge and is going to become a barrister; he "knows all commercial works." He gets as income two or three wagon-loads of silver monthly, and ten or twelve wagon-loads of guineas yearly. He showed me a scrap of paper which he called a telegram announcing two of his ships were coming in loaded with whisky, soda, champagne, and port wine. He is anxious to get to Delhi where he intends to crown his father.

He was sent to Yerrowda Asylum. A year later the Superintendent informed me his condition had got much worse. Speech was thick and slurred, definite paralytic symptoms were progressing.—Professor Powell's *Reports*, 1917.

Case (*b*).—**G.P.I. in Hindu.**—42. Had syphilis in 1899. Was arrested in 1916 strolling about Government House grounds. He explained his action on the ground that he was "Duniya-ki-Malik," Lord of the Earth, Shah-in-Shah. He says he has twenty wives; each wife has twenty-four children. He is Commissioner of Police and will this evening dismiss the whole force. He says he is an electrical machine; that all the lightning enters his body and is stored up as strength. He impregnates his wives by electricity. He has many motor-cars and arrived just now in Bombay from Amritsar (1235 miles) in less than an hour in his motor car, No. 20,304. (N.B.—He has been two days in the police cells.) He has 27,400 lakhs of rupees in the Bombay Bank, 274 lakhs of rupees in the National Bank, 390 lakhs in the Mercantile, the same amount in the Imperial Bank. Yet he prostrated himself and seized my ankles begging me to give him a cigarette.

His pupils were irregular and sluggish, his speech was scanned deliberately, and slurred, his lips and hands tremulous. Wasserman positive.—Professor Powell's *Reports*, 1917.

The **symptoms** usually are failure of memory and of the intellectual powers generally—usual in dementia—accompanied by delusions of possession of exalted power and boundless wealth. Along with these symptoms indicative of affection of the higher nerve-centres, impairment of power—first noticeable

in the tongue and muscles of articulation—is observed, indicating affection of the motor centres. The pupils become irregular; the power of precise co-ordination of movement necessary for the performance of what may be called acquired automatic acts, such as walking, is lost; and general impairment of motor power supervenes. Apparently the centres of sensorial perception, as a rule, do not become markedly affected until near the end of the case, but, as in chronic dementia, deficient sensibility to pain may be an early symptom (see *Case*, p. 363). The deficient sensibility to pain is sometimes of medico-legal importance (see 'General Intellectual Mania,' p. 366).

The offences of a G. P. I. may be classed under three heads:[1] (1) Violence of a peculiarly brutish and irrational character; (2) Sexual impropriety, doubtless partly from lack of judgment and partly from the sexual irritability common in earlier stages; (3) Theft.

III. Mania or Raving Madness.

Active Acquired Insanity.

Under this head may be classed all forms of insanity characterized by disturbance or disorder (as distinguished from want of development, or failure) of the functions of the higher nerve-centres.[2] Unlike amentia and dementia, mania is seldom continuous, there being usually remissions, more or less complete. If complete, a remission constitutes what is termed a 'lucid interval' (see *Case*, p. 363). Mania may come on suddenly or slowly; if slowly certain **premonitory symptoms** are usually first noticed. The chief of these are indigestion, constipation, and sleeplessness; altered or perverted sensations, sometimes amounting to illusions; great irritability, alterations of temper, disposition, and habits, and inability to concentrate the attention on any train of thought. According to Dr. Radcliffe, the leading mental characteristics in insipient insanity are:—(1) Self-conceit, the individual fancying himself wiser, richer, or stronger than he really is. (2) Misanthropy, or general dislike to others without cause; and (3) Suspicion, often leading to delusions of the existence of conspiracies to injure or poison the sufferer.[3]

[1] Dr. C. Norman, *Dublin J. Med. Sc.*, December, 1900.

[2] Some writers on insanity limit the application of the term 'mania' to one particular form of mental disorder, viz. to that in which there is general disorder of all the intellectual powers coupled with excitement—what, in fact, when the term 'mania' is used in the wider sense above stated, may be called the non-melancholic form of general intellectual mania.

[3] Taylor, *Med. Jur.*, II. p. 467.

Case.—**A recurrent mania.**—This case exemplifies a type of insanity which is not uncommonly met with in India, and which is perhaps the saddest of all the mental disorders to which human beings are liable.—R. K. G., a high-caste Hindu of good family and superior education, formerly a schoolmaster, became insane at the age of 29 through, it is stated, over-study. It is important to note that there was no hereditary tendency to mental disorder, and no marked previous alcoholic or other excess. Admitted in 1895 at the age of 40. Every three or four months he suffers from attacks of acute mania, whose duration varies from fourteen to twenty-eight days. During this period he remains naked, is extremely filthy, obscene, restless, excited, and is very noisy, shouting and singing constantly. His speech, a mixture of English and Bengali, is extremely foolish, sentences such as the following being uttered:—"The pains of delivery are in my back!" He is very sleepless, and spends the night singing obscene songs. The attack begins suddenly, but for a day or two prior to it there is a curious alteration in expression which the attendants are well aware of as heralding an attack. He may be dangerously aggressive at the onset, and hence this alteration is carefully observed. Recovery is fairly rapid, and is complete. In the intervals the man is absolutely sane. His memory is good except for the attacks of insanity, of which he remains curiously oblivious.—C. J. R. Milne, 1908.

1. General Intellectual or Ideational Mania.

MELANCHOLIA.

In this form of mania there appears to be general disorder of the functions of the higher nerve-centres. It is divisible into a non-melancholic form and a melancholic form, according as to whether excitement or depression is present. Some writers on insanity limit the application of the term 'mania' to the non-melancholic variety of this form of insanity, and apply the term 'general melancholia,' or 'lypemania,' to the melancholic variety. Sometimes the two forms blend, excitement and depression alternating with one another in the same case.

The **principal symptoms** of general intellectual mania are:—Rapid flow of ideas, expressed with confusion and incoherence; the attention is constantly wandering, and delusions rapidly succeed one another. In one form the individual fears everybody and everything (panophobia); in another he imagines himself pursued by horrible demons (demonomania), the toxic mania of delirium tremens. There may be furious excitement; or, in the melancholic form, great apparent suffering and depression. The muscular power is often much increased, and the patient is often violent and very destructive, rendering great caution necessary in visiting him. The expression is altered, he sleeps but little, and there is often (especially if the case is tending towards general paralysis) deficient sensibility

to pain. The fact that in this form of insanity there is often diminished sensibility to pain, may be of importance in cases where injuries received by insane persons form the subject of an inquiry: (*a*) from its indirectly tending to increase the amount of injury likely to be inflicted during a struggle; and, (*b*) as bearing on the question of the time of infliction of an injury.

A special form of general mania has an acute delirium as its chief feature, and is invariably fatal; it is known as 'Acute Delirious Mania.'

Case.—**Acute delirious mania.**—In this case alcohol was a prominent factor as far as the first attack of mania was concerned. While suffering from this he was brought to the asylum, and beyond evidences of his recent alcoholic bout, there was nothing special about his attack. He then recovered almost completely, but on the fourteenth day, after the cessation of the acute symptoms of the first attack, he again developed acute mania, accompanied, this time, by fever and delirium. To this he succumbed. The following are the details of the case:—

A. P., Goanese, aged about 25, employed in a railway refreshment room, was admitted into the asylum on April 3, 1905. His friends stated that he had always been considered a foolish person, talking nonsense on occasion, and having generally exalted ideas about himself. On the night of March 23, although a usually temperate man, he, assisted by a friend, drank about a bottle and a half of whisky, and after this he became acutely maniacal. He was very excited, abusive and noisy. He broke a quantity of glass and plate. He became very filthy, and for three days he refused his food. He was brought to Lahore and admitted, as stated, on April 3. He was then in a state of exaltation with delusions of being a great chief, of having served in great houses, of having visited the Pope at Rome. He said he had been sent to the asylum by Christ, etc. He had a vacant look, and was extremely restless and loquacious. He was very filthy with excreta, and tore his clothes and bedding into ribbons. He was noisy at night, and slept very little. Under treatment he daily improved, becoming cleanly in his habits, respectful in his attitude and generally behaving quietly. He appeared to be reaching a normal state when, rather suddenly, on the night of the 21st, he became again acutely maniacal, destroying his clothes, etc., and incoherent, with temperature 101°. On the 23rd still feverish (102°), and had become almost unconscious. On the 24th, temperature rose to 104°, when he was visibly delirious, and he died unconscious on the morning of the 25th. No *post mortem* permitted.—C. J. R. Milne, *Ind. Med. Gaz.*, 1906.

Case.—**Melancholia of recent origin.**—M. D., a young Hindu, aged 23, admitted from Midnapore on March 20, 1904. Except that his maternal uncle was an idiot there is no other history of insanity in the family. In December, 1903, his house was burnt down, and at the same time his sister and other relatives died of small-pox, which was raging in the village. This caused him to become insane, and in January he attacked his mother and wife one day with a knife. He was then arrested, sent to jail, and thence to the asylum, where he was admitted in a state of extreme mental depression, weeping constantly, declining to speak, and paying no attention to anything. He recovered gradually, and in November, 1904,

was declared sane, and has continued in this condition.—C. J. R. Milne, 1908.

Case.—**Chronic melancholia.**—B. A., Mussalman woman. At the age of 32 is said to have had five children at birth, four of which were still-born and one alive, which died shortly afterwards. During these births a urethral fistula was caused, and was left untreated. This caused her to be an object of disgust, and her mind gave way under the combined influences of bodily trouble and grief. In her insane state she set fire to a godown, and was sent to the asylum, where she has continued in a state of chronic mental depression. She is very irritable, and if thwarted, may be aggressive. She is always in a state of abject misery, and no amount of kindness or comfort has any effect. Treatment of her urethral condition is negatived by her being in an advanced condition of pulmonary tuberculosis.—C. J. R. Milne, 1908.

Insanity with epilepsy.—Insanity consequent on epilepsy is not infrequently seen in India. In most of the sufferers the epilepsy is said to have come on after puberty. Some of these epileptics are continuously insane, while others are only insane before or after their seizures. The epileptic seizure, the classical 'grand mal,' may be replaced by an attack of acute mania, generally of short duration, and from a medico-legal point of view this is important. Epileptic insanes are among the most dangerous of all insanes, and those in India form no exception to the rule. The type of insanity met with in epileptics is most commonly mania, but occasionally an epileptic melancholia may be observed. Dementia generally comes on early in epileptic cases, and is usually profound. Epileptics are sorely tried during very hot weather, and are then liable to attacks of status epilepticus, frequently fatal.

Case.—**Epileptic mania homicide.**—R. R., from Tributary Orissa, began to suffer from epilepsy at the age of 25, in 1900. The first fit was a very severe one, and he fell into a fire, extensively scarring his left chest and arm. On August 7, 1905, he was sentenced to transportation for life for murdering his mother under the following circumstances. He was seen one day to drag his mother, who was bleeding from a wound of the head, from his house; in his other hand he had a bloody axe. Having deposited his mother's body, he sat down quietly by his door, and was arrested. It was then observed that he was in a dazed state. He admitted his crime, and said he had mistaken his mother for a tiger. He had dealt his mother four blows, any one of which might have caused death, and one over right shoulder and neck had severed the spinal cord. It is not recorded, but it is possible that just prior to this murder the man had an epileptic seizure. It was observed in jail that after his fits he became wildly excited and required restraint. He was then sent to the asylum. An irritable man who suffers from two or three major epileptic seizures monthly. Is dull and depressed before the fit, and is very excited immediately after for a couple of hours, and has then to be kept apart.—C. J. R. Milne, 1908.

Toxic insanity is most commonly alcoholic, or due to Indian hemp or puerperal sepsis.

1. **Alcoholic insanity.**—Insanity due to alcohol is now (1917) by no means rare in India.

Case.—**Alcoholic insanity.**—R. S., an aborigine from Midnapore, admitted in December, 1904, into Dullunda Asylum with the following history: For many years had indulged excessively in native liquor (pachai—a spirit distilled from rice). On two occasions he had had attacks of acute mania. During the second of these, which followed directly a bout of great intemperance, he came up one evening to another Santal, who was sitting in front of his house, and without saying a word killed him with an axe. He was then arrested and sent to jail, where he was admitted in a state of wild excitement. He was then sent to the asylum. He was sane on admission, and continued to be sane until March, 1905, when he began suddenly to talk nonsense, and then fell into a state of stuporous depression. Some days later he was caught in the act of making preparations for committing suicide. This state of depression was followed by an attack of acute mania which was characterized by noise, aggressiveness, and extremely filthy habits. This gradually subsided after a duration of nearly two months. He then recovered and continued to be sane, and was sent for trial in September, 1905, and returned to the asylum in March, 1906. In May, 1906, another attack of depression, with another suicidal attempt, was again followed by a period of maniacal excitement, shorter in duration, however, than that of the previous year. He recovered completely and continued sane for a year. In August, 1907, he had an attack of simple mania lasting for three weeks. In January and February of the present year, he has had two successive short attacks, and his case is developing into one of recurrent mania.—C. J. R. Milne, 1908.

2. **Hemp drugs.**—Major G. F. W. Ewens has shown[1] that indulgence in hemp drugs is responsible for a great many of the cases of mania admitted into the Punjab Asylum. Of 543 such cases admitted in the triennium 1900–1903, in 161 their causation could be reasonably assigned to the hemp habit. This proportion is very high, and is higher than in the Lower Provinces. In Berhampore, of 332 cases of mania, in only 56 can indulgence in hemp be attributed as the cause. The reason of this, however, in all probability lies in the fact that whereas in the Punjab the more potent resin—charas—is the preparation used, in Bengal it is ganja, a much milder drug. With an experience of both provinces, I can further state that the toxic mania due to charas indulgence is much greater in degree to that seen after indulgence in ganja. Both are, however, exactly similar in type. The Hemp Drugs Commission came to the conclusion that hemp drug indulgence had been grossly exaggerated as a factor in the production of insanity, and that in very few cases could it be definitely shown that previous hemp smoking had caused the mental alienation.

[1] *Ind. Med. Gaz.*, November, 1904; and *Insanity in India*, pp. 128, etc., 1908.

That their conclusions were incorrect Ewens has definitely proved as regards the causation of mania.

Hemp drug indulgence, either as ganja or as charas, is common in many parts of India. It is chiefly in vogue among religious mendicants—the vagabond pests of India—and among the lower castes resident in the larger towns and villages. Were it not for fakirs and sadhus, who extol its virtues, the practice would soon die out. Comparatively few persons, then, indulge in these drugs; were larger numbers to do so our asylum populations would become proportionately increased.

The drug is partaken of in one of three principal forms: bhang, ganja, or charas. Bhang is a decoction of the leaves, and is very mild as a rule, but it may be the reverse, and is then frequently adulterated with dhatura and other drugs. Ganja are the dried flowering tops of the female plants matted together by resin. It is smoked along with tobacco, as is charas, which is the crude resin extracted from the flowering heads by rubbing these in the hands and scraping off the resin left adherent to the palms. It is also contained in the sweetmeat Majun, which see.

A single indulgence in any of these forms may produce a prolonged intoxication or a mania transitoria. Continued and excessive indulgence leads sooner or later, in many of those who indulge, to an attack of acute mania of a noisy, happy, elated character, which varies in degree in each individual. Filthy habits, expansive delusions, and a careless but dangerous tendency to aggressiveness are constant features. Physical signs are absent except a peculiar conjuctival congestion. This state of mania may last for a varying period. It may then be completely recovered from, or the subject may fall into a state of mild chronic mania with weakmindedness, which is chiefly remarkable for its defects in memory of time and place. The period of mania in ganja cases is nearly always a period of oblivion. Old hemp cases in asylums are remarkable for their false ideas of time. Their ages, as told by them, are absurdly greater or less than the actuals. Recurrences are common if the habit is resumed. The craving for the drug soon passes off and the abrupt manner in which the indulgence can be stopped is remarkable. A few cases terminate in complete dementia, but a very partial dementia is the commonest issue of hemp manias.

Case.—**Mania transitoria following *bhang* drinking.**—S. R., a Hindu boy of 17, was admitted into the asylum on April 1, 1905, with the following history: He had been employed at Ajmere by a Babu in some domestic capacity. Some difference of opinion had arisen between him and one of the other servants: the patient, being the younger, agreed

to make up the quarrel and was induced to drink a tumblerful of *bhang* by the other, as if to celebrate the settling of their differences. This occurred on the evening of March 25, 1905, and on the following evening, having apparently enjoyed his first potation, he was given another by the same person. Following this second potation his memory became a blank, and it was not until April 6 that he recovered his senses and found himself a patient in the asylum. From his friends and others we ascertained that on March 27 he developed an attack of acute mania, and was dismissed from the service of his employer, who, however, sent him to his home at Jhelum in charge of another servant. At Lahore apparently he became obstreperous; his friends deserted him, and, being found disturbing the peace, he was taken in charge by the police and brought here. On admission he was in a state of acute mania: he was noisy, exalted, and destructive. On being asked his name he shouted it deliberately, emphasizing each syllable, at pitch of his voice, repeating it several times. His face was flushed and his conjunctivæ were congested. He tore his clothes and preferred to remain naked—covering himself with dust and filth. After about five days he began to recover, and rapidly regained his normal healthy condition. He gave a coherent account, which was afterwards fully verified, of the occurrences preceding his attack. He remained in the asylum in a perfectly sane condition, being a great help to the institution as a hospital attendant, for three months, when he was discharged to the care of his friends.—C. J. R. Milne, 1906.

Case.—**Mania transitoria following *charas* smoking.**—N. G., a Hindu, aged 30, a criminal lunatic, was admitted into the asylum on November 26, 1900, being confined under *s.* 471 Criminal Procedure Code. On February 21, 1900, this man killed an old woman by beating her on the head with a stick, and remained sitting by the body after the deed. No apparent motive for the murder could be ascertained. Evidence was given to show that the patient's father had been insane, and the patient had on previous occasions exhibited signs of insanity. He was therefore acquitted on the ground of insanity, and confined in the asylum under the section quoted. No history of indulgence in drugs was forthcoming at the trial. When admitted he seemed dull and stupid, and his memory was apparently defective. Otherwise he appeared to be quite sane. Eventually it is recorded in his case that the man is "an unprincipled scheming liar." He was reckoned as 'sane' until July, 1905. On the 14th of that month he was found in his cubicle smoking *charas*, being then in a dazed condition: a quantity of *charas* was also found in his room. He had, as was discovered, obtained this charas from the private servant of another patient, a sirdar of good family. Following this bout of *charas* smoking he became acutely maniacal, being violent, noisy and destructive. He remained thus for nearly three weeks and then gradually recovered. He is quite sane at present, works well, but is an expert in the art of mendacity.—C. J. R. Milne, 1906.

Case.—**A third recurrence of the drug habit followed by imperfect recovery.**—In Major Ewens' series this is No. 66, and the case is also noted in the text of his article. His two previous admissions are there recorded, and also his own concise history of his drug-taking habits. From April, 1903, until March, 1905, he was known to have not again resorted to *bhang*, and to have followed his trade in the city here. On April 21, 1905, he was admitted in a state of furious mania. He was extremely restless: very noisy, shouting and singing constantly the choicest of abuse; he had destroyed all his clothes; he dug with his fingers

huge holes in his cell into which he could disappear bodily, and he is not a small man; he attempted to extract the bricks from the partition walls of his cubicle, and this too with a horrible gangrenous finger, which eventually dropped off, and which could not be dressed, but was treated by the patient with smearings of filth. He was also extremely filthy with his excreta. With varying acuteness this state lasted for about four weeks, when he began to recover, allowing the stump of his finger to be dressed, and becoming generally cleaner in his habits. In June he had without discoverable cause, another attack of acute mania lasting about four days. Improvement followed this, but it has never been perfect, and his previous condition has not yet, ten months after his attack, been attained. Although he can talk sensibly to a certain degree, he is in a state of foolish exaltation, constantly making unreasonable requests, asking for bicycles, etc. His memory is very defective and his speech childish. He has become very fond, when he gets the opportunity, of attiring himself in a fantastic manner, being particularly keen on pagris of grotesque design.—C. J. R. Milne, 1906.

Case.—**Chronic mania following prolonged indulgence in** *bhang and charas.*—H. N. L., aged 30, a Brahmin employed in the Railway Mail Service, was admitted on April 11, 1905. He gave a history of having drunk a pice worth of bhang daily for eight years along with others, and also of having smoked *charas* intermittently for two years. His motive was to make himself more fit for his work. His memory was, when he was admitted, less affected than these cases usually are, and by interrogation a coherent account of his past life was obtained from him, which was subsequently corroborated by his father and friends. His father stated that the son had become mentally altered four months prior to admission, and that, having threatened his wife and mother-in-law, they left him. He was also found at the Lahore station in a state of mania, and was brought to the asylum. On admission he was in a state of great exaltation and excitement, and was evidently well pleased with himself. He talked in a loud sonorous voice, bursting out at the end of every sentence into a fit of exaggerated laughter, which lasted for a minute or more. He exhibited delusions of wealth and position. He has remained in this condition for about ten months, being at times more communicative than at others, but being easily aroused into a foolish declamation of his powers, interpolated with much amusing laughter. He is extremely proud and is solitary in his habits. His physical health remains good, but he is mentally deteriorating.—C. J. R. Milne, 1906.

2. Partial Intellectual, or Monomania.

DELUSIONAL INSANITY.

The leading character of this form of insanity, which is now generally known as **delusional insanity,** may be stated to be the affection of ideation as regards one particular only. Hence there is either only one delusion, or, in more developed cases, a series of delusions, connected together by one morbid idea (see *Case* (*b*), below). The delusion may be of the most ridiculous character; the individual may believe himself to be made of glass, or to be dead, or to be some celebrated character. In the

melancholic form of monomania the delusion or delusions are frequently of a **religious** character (religious monomania), or, as in *Case* (*b*), delusions of persecution (monomania of persecution). Such delusions may lead to the commission of homicide (see *Cases* (*c*) and (*d*)), or to suicide. Monomaniacs, in fact, may, under the influence of their delusions, exhibit propensities similar to those exhibited, without delusion, in the various forms of partial moral mania.

In markedly distinct cases of monomania, the individual appears to be perfectly sane on all points unconnected with his delusion or delusions, and only betray excitement or depression when these are touched upon. In such cases (especially in non-melancholic cases), the individual may appear to reason correctly and accurately on matters unconnected with his delusions, and even in matters connected with them his reasoning may be accurate, although his conclusions, being founded on false premises, are erroneous. Sometimes in these cases, particularly if the individual has any powerful motive for concealing his delusion, there may be great difficulty in detecting its existence (see *Cases* (*e*) and (*f*)). In other cases, specially advanced cases, the reasoning powers appear generally affected, so that it becomes difficult to decide whether the case is one of partial, or one of general ideational insanity. Monomaniacs are often readily imposed upon and controlled by a person affecting to believe in their delusions (see *Cases* (*f*) and (*g*)).

Case (*a*).—**Delusional insanity.**—Persecution by telephones.—M. L. G., Bengali Kayastha, aged 42 on admission in 1894, a resident of Calcutta, was formerly head clerk to the Inspector of Schools at the Presidency. Had a lawsuit with a distant cousin, P. N., which he lost, since which time, 1890, he has been insane, exhibiting marked delusions that P. N. and his friends were constantly persecuting him with electric shocks, transmitted by telephones. In 1894 he attacked P. N. with an axe, and was consequently sent to the asylum, where he has spent nearly fourteen years without the slightest mental alteration. All his troubles are due to P. N. and his telephones. Quite recently he was unable to walk because of this persecution, and had to be moved about.—C. J. R. Milne, 1908.

Case (*b*).—**Monomania of persecution;** multiple delusions connected with one morbid idea.—A female patient was "perfectly convinced of the existence of a persecuting fellow in a room above her own, who vented all his malignity upon her by means of certain machinery and wires. . . . He 'brays' her in the night with three of these wires, so that she is stiff in the morning, and covered with marks as if she had been switched. . . . At other times he will thrust three wires into her mouth, which leave 'a very bitter verdigris *taste*' therein. She protests that she can see a 'hole like the cut of knife' in one corner of the ceiling, through which he introduces the wires. . . . She has stopped her clock and covered it up, because he used to employ his wires to make it strike some twenty times in the night, in order to disturb her." He also, she believes,

delights in sending her to sleep with chloroform, which she feels dropping from the ceiling upon her cap.—Bucknill and Tuke, p. 219.

Case (*c*).—**Religious monomania.**—Homicide.—"A woman consulted a medical man as to pains in her head, loss of appetite, and low spirits after her delivery: she was also suffering from religious despondency. While in this state she got up in the night and drowned four of her children in a cistern. She gave this account of the act: she washed the children, put them to bed, and retired herself, about 10 o'clock, but could not sleep; and between 12 and 1 o'clock it was suggested to her mind, as she says, by a black shadowy figure, that if they were in heaven they would be out of danger and better done to than she could do for them. It was still further suggested to her mind in the same way that she could easily put them into the cistern, and she at once proceeded to do so; it was better for them to die young than to grow up wicked."—*Reg.* v. *Wilson*, Lincoln Sum. Ass., 1864; Taylor, *Med. Jur.*, II. p. 554.

Case (*d*).—**Monomania of persecution.**—Homicide.—"A young man who had previously had a few epileptic fits, became extremely melancholic. Being possessed with the idea that he was to be murdered in his father's house, he made frequent attempts to escape from it. . . . His father was a butcher; and the young man, becoming calmer after a time, and being thought trustworthy, was permitted at his own request to be present at the slaughter of an ox, but when all was finished, he did not wish to return home. His friends, however, pressed him, and two of them taking him by the arm in a friendly manner, accompanied him towards his home; but just as he approached the door of his house he suddenly drew out a butcher's knife, which he had concealed, and stabbed to the heart one of them, fleeing immediately to the forest, where he passed the night. Next morning he went to the house of a relative who lived some distance off, and said that he had run away from home, as they wished to kill him there."—Maudsley's *Phys. and Path. of Mind*, p. 371.

Case (*e*).—**Monomania of persecution detected with difficulty.**—"Dr. A. T. Thomson was requested to see a gentleman, whose friends were desirous of placing him under restraint, being well assured of his insanity from the supervention of uncontrollable outbreaks of temper, to which he had never previously given way, though they could find no ostensible ground in his conversation or actions which would legally justify the use of coercive measures. Several medical men had been consulted, all of whom had failed to obtain any such justification. . . . Dr. Thomson, struck with the evidence of violent passion, afforded by the damages done to the furniture of this gentleman's apartments, 'felt convinced that there was some perversion of feelings or intellect which it was his business to discover.' For two hours he conversed with his patient on a variety of topics, and never enjoyed a more agreeable or instructive conversation, his patient being evidently a man of great attainments. Dr. Thomson was beginning to despair of finding out the mystery of his disorder, when it chanced that animal magnetism was adverted to, on which the patient began to speak of an influence which some of his relatives had acquired over him by this agency, described in the most vehement language the suffering he endured through these means, and vowed vengeance against his persecutors with such terrible excitement, that it was obviously necessary, alike for their security and his own welfare, that he should be placed under restraint."—Carpenter's *Mental Physiology*, p. 669.

Case (*f*).—**Monomania; the delusion only discoverable with difficulty.**—"A person, who had been confined in a lunatic asylum, prosecuted his

brother and the keeper of the asylum for false imprisonment and duress. Erskine was informed that the man was undoubtedly insane, but was not told the particular form which the malady assumed. The prosecutor, himself a witness in support of the indictment, was put into the witness-box and examined; and when Erskine came to cross-examine him, he found his evidence clear, distinct, collected, and rational. He tried to discover some alienation of mind: but during a cross-examination, conducted with all the skill and sagacity of which he was master, for nearly an hour he was completely foiled; the answers were perfectly rational—there was not the slightest sign of mental alienation. A gentleman, however, who had been accidentally detained, came into court, and whispered in Erskine's ear that the witness thought he was the Saviour of mankind. On receiving the hint, Erskine made a low bow to the witness, addressed him in terms of great reverence, and respectfully begged to apologize for the unceremonious manner in which he had treated a person of his sacred character, and called him by the name of Christ. The man immediately said, 'Thou has spoken truly; I am the Christ.'"—Case related by Erskine during his defence of Hadfield, Browne, *Med. Jurisp. of Insanity*, p. 290.

Case (*g*).—**Monomania readily controlled.**—"Henry Weber, Sir Walter Scott's private secretary, became addicted to habits of intoxication, which injured his health. One evening, Scott, after Weber's return from Edinburgh, observed Weber's eye fixed upon him with unusual solemnity of expression. On inquiring after his health, Weber rose and said, 'Mr. Scott, you have long insulted me, and I can bear it no longer. I have brought a pair of pistols with me, and must insist on your taking one instantly,' and with that he produced the weapons and laid one of them on Scott's manuscript. 'You are mistaken, I think,' said Scott, 'in your way of setting about this affair; but no matter. It can, however, be no part of your object to annoy Mrs. Scott and the children; therefore, if you please, we will put the pistols in the drawer till after dinner, and then arrange to go out like gentlemen.' Weber answered with equal coolness, 'I believe that will be better,' and laid the second pistol also on the table. Scott locked them both up in his desk, and said, 'I am glad you feel the propriety of what I suggested; let me only request further that nothing may occur while we are at dinner to give my wife any suspicion of what has been passing.' Weber again assented, and Scott withdrew to his dressing-room, despatched a message to one of Weber's intimate companions, and had the maniac secured and placed in confinement."—Guy's *For. Med.*, p. 188.

Somnambulism, or 'sleep walking,' is allied to epilepsy and the artificially produced state of mesmerism or hypnotism (see p. 377). In this condition the higher or intellectual nerve-centres appear to be in a state of partial activity only, or, as in the higher form of somnambulism, in a state of full activity to *one* train of impressions, but inactive as regards others. In this condition, while bent in accomplishing one object, very elaborate acts may be performed, and dangerous ground traversed heedlessly which would disconcert the mind when wide awake. Hence the mere fact of the performance of such an act does not of itself indicate that the higher or intellectual nerve-centres were in full activity at the time of its performance. This is

obviously of much medico-legal importance, seeing that such acts, done during a condition of partial activity only, of these higher centres, may result in the death or injury of others, and form the subject of a criminal inquiry.

If somnambulism be proved, the accused is exonerated from responsibility for any criminal act; and this is also the case if the person be suddenly roused from a deep sleep.

Case.—**Somnambulist acquitted of murder.**—"In 1878 a man named Fraser, in Glasgow, was tried for the murder of his child by beating it against a wall. He was acquitted on the ground of being unconscious of the nature of his act by reason of somnambulism. He was sprung from an epileptic and insane stock, his mother died in an epileptic fit, and some of his relatives were insane."—Husband's *F. M.*, p. 712.

Case.—**Somnambulism.**—"A butcher's boy, about sixteen years old, apparently in perfect health, after dozing a few minutes in his chair, suddenly started up, and began to employ himself about his usual avocations. He had saddled and mounted his horse, and it was with the greatest difficulty that those around him could remove him from the saddle and carry him within doors. While he was held in the chair by force, he continued violently the actions of kicking, whipping, and spurring. His observations regarding orders from his master's customers, the payment at the turnpike gate, etc., were seemingly rational. The eyes, when opened, were perfectly sensible to light. It appears that flagellation even had no effect in restoring the patient to a proper sense of his condition. The pulse in this case was 130 full and hard. On the abstraction of thirty ounces of blood, it sank to eighty, and diaphoresis ensued. After labouring under this frenzy for the space of an hour he became sensible, was astonished at what he was told had happened, and stated that he recollected nothing subsequent to his having fetched some water, and moved from one chair to another, which indeed he had done immediately before his delirium came on."—Browne's *Med. Jur. of Insanity*, p. 237.

Case.—**Stabbing performed during sleep.**—"Two persons who had been hunting during the day slept together at night. One of them was renewing the chase in his dream, and imagining himself present at the death of the stag, cried out, 'I'll kill him! I'll kill him!' The other, awakened by the noise, got out of bed, and by the light of the moon beheld the sleeper give several deadly stabs with a knife on that part of the bed which he had just quitted."—Taylor's *Med. Jur.*, 2nd ed., II. p. 600.

Case.—**A man stabbed by his brother under similar circumstances.**—"A Spaniard, *æt.* twenty-six, who had been a soldier, always of good conduct, and in tolerable health, was subject every spring to epistaxis, also to talking in his sleep. The spring of 1854 passed without epistaxis, and from this time, particularly during the night, he was subject to certain moral disturbance, for which purging was advised. Travelling with a brother, and sleeping in the same bed, he was attacked during the night by this excitement, fancied that his bedfellow was going to kill him, and seizing a knife he plunged it into his neck. He then went out and slept on the staircase two hours. When he awoke he had some obscure consciousness of what he had done, and on seeing his dead brother, he was in despair, and wounded himself severely. The flow of blood restored his reason, and he called for help, and after some time told all the circumstances. The man was tried for the murder, but was acquitted on the medical evidence."—Browne's *Med. Jur. of Insanity*, p. 241.

Case.—**A man suddenly aroused from sleep stabs another.**—"A pedlar, who was in the habit of walking about the country armed with a sword-stick, was awakened one evening, while lying asleep on the high-road, by a man suddenly seizing him and shaking him by the shoulders. The man, who was walking by with some companions, had done this out of a joke. The pedlar suddenly awoke, drew his sword, and stabbed the man, who soon afterwards died. He was tried for manslaughter, and, although his irresponsibility was strongly urged by his counsel, was convicted."—*Ib.*, p. 241.

Case.—**Higher form of somnambulism.**—"An eminent Scottish lawyer had been consulted about a case of great difficulty and importance, and had been studying it closely and anxiously for several days. One night his wife saw him rise from his bed and go to a writing-desk which stood in his bedroom. He then sat down and wrote a long paper, which he carefully put by in his desk and returned to bed. The following morning he told his wife that he had a most interesting dream; that he had dreamt of delivering a clear luminous opinion respecting a case which had exceedingly perplexed him, and that he would give anything to recover the train of thought which had passed before him in his dream. She then directed him to his writing-desk, where he found the opinion clearly and fully written out."—Carpenter's *Mental Phys.*, p. 593.

Case.—**Higher form of somnambulism.**—"A banking house once gave to a Dutch professor of mathematics (Professor Van Swinden, of Amsterdam) a question to solve which required a long and difficult calculation. He first tried it himself several times but never without mistake; so he handed it over to ten of his pupils. One of these attacked the problem with great vigour, but more than once without success. Late in the night which preceded the day fixed for the giving in of the answers, he went to bed baffled and tired. But in the morning, most strange to relate, he finds a paper on his desk, in his own handwriting, on which the problem is solved, without a single blunder. He had calculated the problem in his sleep, and in the dark. It was singularly clear and condensed, and the professor himself declared that he had never thought of a solution so simple and concise."—Guy's *Factors of Unsound Mind*, p. 71.

Hypnotism or mesmerism is an artificially produced state which is allied to somnambulism. It is now of medico-legal interest chiefly with reference to rape (p. 301) or testamentary cases. The hypnotism trance may be induced by administering a dose of formaldehyde, and then waving a candle before the eyes of the person seated in a chair, with the head resting on a high pillow.

Before the introduction of chloroform it was largely used by Dr. J. Esdaile, I.M.S., in Calcutta, as an anæsthetic for painless operations. On the 4th April, 1845, he had to perform an operation on a Hindu prisoner at Hooghly, and he tried the 'mesmeric passes' he had read about, and to his delight the patient passed into a state of deep sleep. That there was "a complete suspension of sensibility to external impressions of the most painful kind" was vouched for by the collector and the judge of Hooghly. Esdaile wrote an account

of this and other cases in the now extinct *Indian Journal of Medical and Physical Science* (May, 1845). The medical press declared that Esdaile was duped, but when he had collected 100 cases, he reported the matter to the Government of Bengal, who appointed a committee of four medical men to report on the matter. The committee carefully investigated nine operations performed under this influence by Esdaile, and reported very favourably upon it, recommending that assistance should be given to Esdaile to continue his investigations. A small hospital was set apart for him in Calcutta in November, 1846, and after a year's experience the medical visitors, appointed by Government, reported that "complete insensibility to pain was produced by mesmerism in the most severe operations." The new Governor-General, the great Dalhousie, ever a friend of the medical profession in India, congratulated Esdaile and appointed him to be a Presidency Surgeon. But already, in 1848, the use of chloroform had begun in India, and though Esdaile continued to work with mesmerism, there can be little doubt that chloroform killed off mesmerism as an anæsthetic agent. Esdaile retired from the service in June, 1851, after twenty years' service. He left a record of 261 painless operations done by him under mesmerism, including many elephantiasis tumours, one weighing 105 lbs., which other surgeons had declined to touch.[1]

3. General Moral Mania.

Moral or affective mania (*mania sine delirio*) is distinguished from intellectual or ideational mania by the absence of delusions, although lawyers find it hard to accept the view that insanity is possible without delusion. It may best be defined, in the words of Ogston,[2] as "consisting in a morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral dispositions, and natural impulses, without any remarkable disorder of the intellect, or knowing and reasoning faculties." In general moral mania this morbid perversion is general, and, as a consequence, the individual exhibits several depraved propensities. He is on the borderland between habitual vice and insanity. The three undernoted cases are examples of this form of mania.

Case.—**General moral mania.**—"W. R., *æt.* 27, had been eight times in the House of Correction. His father was an epileptic, and he himself had been subject to convulsions when teething, and at intervals during

[1] Dr. Crawford in *Ind. Med. Gaz.*, 1901, p. 465.
[2] *Lect., Med. Jur.*, p. 304.

his after-life. He tortured animals, picked out the eyes of a kitten with a fork. He lied and stole. He was expelled from school as too bad to be kept. He afterwards consorted with the worst characters; was drunken, debauched, dishonest. He attempted or pretended to commit suicide. He was utterly false and untrustworthy. He delighted in torturing those patients who were, like himself, confined in the lunatic asylum, and who were too weak to resent injury with violence. He was indelicate in the presence of females, and attempted a rape on his mother and on his sister. Yet with all he was intelligent, exceedingly cunning, and, while actually the victim of epileptic seizures, he was prone to feign fits, and did it with considerable ability. In spite of careful watching, he repeatedly effected his escape; was exceedingly vain, and in the presence of some persons seemed to be exceedingly devout. He was ingenious in excusing his errors, and, although exceedingly mischievous, was careful to avoid disagreeable consequences." This individual, Browne further remarks, was possessed of "an intelligence of such high order as to enable him thoroughly to understand the relation between a found-out crime and its punishment, for he invariably tried to conceal the commission of the criminal act by lies, hypocrisy, and various clever explanations."—Browne's *Med. Jur. of Insanity*, p. 114.

Case.—**General moral mania.**—"An old man, aged 69, who had been in one asylum or another for the last fifteen years of his life. He had great intellectual power, could compose well, write tolerable poetry with much fluency, and was an excellent keeper of accounts. There was no delusion of any kind, and yet he was the most hopeless and trying of mortals to deal with. Morally he was utterly depraved; he would steal and hide whatever he could, and several times made his escape from the asylum with marvellous ingenuity. He then pawned what he had stolen, begged, and lied with such plausibility that he deceived many people, until he finally got into the hands of the police, or was discovered in a most wretched state in the company of the lowest mortals in the lowest part of the town. In the earlier part of his insane career, which began when he was 48 years old, he was several times in prison for stealing. In the asylum he was a most troublesome patient; he could make excellent suggestions, and write out admirable rules for its management, and was very acute in detecting any negligence or abuse on the part of the attendants when they displeased him, but he was always on the watch to evade the regulations of the house, and when detected, he was most abusive, foul, and blasphemous in his language. He was something of an artist, and delighted to draw abominable pictures of naked men and women and to exhibit them to those patients who were addicted to self-abuse. He could not be trusted with female patients, for he would attempt to take indecent liberties with the most demented creatures. In short, he had no moral sense whatever; while all the fault that could be found with his very acute intellect was that it was entirely engaged in the service of his depravity. . . . At long intervals, sometimes of two years, this patient became profoundly melancholic for two or three months, refused to take food, and was as plainly insane as any patient in the asylum. It was in an attack of this sort also that his disease first commenced."—Maudsley's *Phys. and Path. of Mind*, p. 362.

Case.—**General moral mania.**—Viciousness and depravity.—V. B., age about 22, admitted 16th August, 1899, into Lahore Asylum, is an habitual criminal who has apparently never in his life maintained himself by honest labour. While in jail for a term of imprisonment for receiving stolen property, he was found so constantly troublesome and

given to making unprovoked assaults on the weaker prisoners, being filthy, and utterly unamenable to reason and punishment, that he was finally certified as a lunatic and sent here. Absolutely no previous or family history is obtainable of a reliable nature.

Beyond a certain amount of irritability he showed no sign of insanity, but he was soon found to be vicious, cruel and animal, disobedient and revengeful, tearing up his bedding if checked, and destroying the materials of his work if spoken to. It was considered that his conduct denoted him at that time to be more of a criminal than a lunatic, and he was discharged at the expiration of his sentence in December, 1900, but his conduct obliging the authorities to put him under security, he was sent back to jail, and again later on was transferred here with the same history (early in 1901), and since then his conduct has never varied. He is a tall, well-built young man of most repellent aspect, being thick-lipped, with one ear cropped, and his face plentifully scarred as a result of old fights and injuries. He is clean, tidy, without any of the usual signs of insanity, that is to say, he speaks sensibly, intelligently, and coherently, is without delusion or hallucinations, and works well and skilfully with application when it so pleases him. He sleeps and eats well, is not an epileptic, and is in good physical health. But he is, on the other hand, most vicious, immoral and unprincipled, a fluent liar, a thief, and though a coward, constantly found committing assaults on the weak and helpless lunatics; it is said that he assisted another patient to kick a man to death; he is perpetually endeavouring to commit sodomy, always ill-treating and bullying the weak dements and idiots, and daily concerned in some quarrel or grievance which the others come to complain about, mischievous, disobedient, absolutely unreliable and uncontrollable, the perfect pest of the whole asylum, on whom no training, no kindness, persuasion, or threats have the slightest permanent influence.

Now, this man's actions have all the appearance of pure viciousness; he has perfect memory; he lies to excuse himself or for some other end; he does not steal from a magpie love of collection, but with a definite end and purpose: he is grossly immoral, and his acts of assault and cruelty are always on those weaker than himself and not done out of pure insane impulse or in ungovernable passion. It is doubtful how much they are due to the failure of volition, for when caught and threatened with the deprivation of some privilege or the imposition of a punishment he will remain for some days quietly and orderly, but the effect gradually wears off, and he again follows his old evil courses. In his case his general intelligence is of such a high order as to preclude the possibility of suggesting his act as due to imbecility or weak-mindedness. It may be also pointed out that being so intelligent, it is reasonable to suppose that he would exercise more self-control to escape from his present uncomfortable position, and his failure to do so is a very strong evidence of his insanity. He is certainly irresponsible and incapable of seeing things as others do, and his general conduct for ordinary public security and comfort renders it imperative that he should remain secluded either in jail or a lunatic asylum, even though his history may always give different observers opportunities for debating as to which particular institution he more properly belongs.—G. F. W. Ewens, *Ind. Med. Gaz.*, 1902, p. 230.

Impulsive insanity.—Those persons who act criminally on impulse even when their action has the aspect of premeditation, may yet be entitled to plead partial irresponsibility. The antecedents of this state of mind must be investigated, for the changed self which eventuates in the criminal explosive

act is not necessarily of rapid growth. Although the act is, as such acts are, sudden and explosive, yet it is only the terminal of a process which may have been going on for some time, and therefore it is not only the act itself which has to be considered, but the whole process of which it is a part, and the impairment of the mental condition may be traced to environment or a combination of circumstances forming a new and narrowed self, incapable of deliberation and dangerously explosive on the slightest provocation; whilst there seems reason to believe that many of the explosive acts of a homicidal as well as suicidal character are attended with an imperfectly conscious and relatively mechanical condition.[1]

4. Partial Moral Mania.

This form of mania only differs from the preceding variety in the fact that the morbid perversion is not general but limited to one or two particulars. Hence, in partial moral mania, the individual exhibits one or two, instead of several, morbid propensities. Under this form of mania may be classed the impulsive or explosive insanity of some writers. Different varieties of partial moral mania are distinguished according to the special propensity present, for example, homicidal mania, suicidal mania, kleptomania, pyromania, etc. Medico-legally the more important kinds are the following:—

Homicidal Mania.

Homicide, as has been already pointed out in *Cases* (*d*) and (*e*), p. 374, may be the result of a *delusion*, such as the belief that the victim is persecuting the accused. Such cases, according to Ray's classification of mania, belong to intellectual insanity, usually to the partial form, and may, therefore, be called cases of '*homicidal monomania.*' In some cases, however, the homicide, or attempt at homicide, appears to be the result of an insane propensity or '**impulse,**' unaccompanied, at least so far as can be ascertained, by a delusion, and so would be classed as moral or effective mania, usually of the partial variety, and to these the term '**homicidal mania**' is commonly applied. Murder may also be committed by insane melancholics in the belief that they are saving the person from some danger, etc., by women suffering from puerperal insanity (here the victim is usually their infant), or in the frenzy of an epileptic seizure.

Case.—**Homicidal mania, gradual approach.**—"A young man, *æt.* 25, and of gentlemanly appearance, after giving his address, and declaring himself to be a schoolmaster in a certain well-known college

[1] T. Claye Shaw, M.D., *Trans. Med. Leg. Soc.*, 1903, I. 31.

(in Paris), begged that the Commissary of Police would take him in charge with a view to his confinement in the Asylum of St. Ann. He then explained that he was not mad in every respect; on the contrary, he possessed the full use of his mind, only while sleeping among the pupils confided to his charge, he was seized with the most destructive inclinations. Night after night in an agony of fear he had struggled with himself, and it was with the greatest difficulty that so far he had succeeded in restraining his intense desire to strangle one or two of the little boys. Now all his energies were exhausted. He felt that this unknown power would ultimately triumph over him, and rather than commit the crime he placed himself in the hands of the police. At this moment a boy accused of theft was brought into the room. The eyes of the schoolmaster were immediately lit with a strange light; and had it not been for the timely assistance of a brawny policeman, the boy would have been throttled before the eyes of justice."—Bucknill and Tuke, p. 268.

The proportion of criminal to civil insanes is enormously greater in India than in England. Whereas in the former, it is one to three, in the latter it is one to one hundred and thirty. One of the reasons for this unenviable state of affairs is that in India a great many dangerous insanes are permitted to freely wander about or are allowed to be kept by their friends, with the result that they are only consigned to asylums when apprehended by the police for some breach of the law, most commonly an act of homicidal violence. It is noteworthy that a very large percentage of the criminal insanes in Indian asylums should have actually committed murders. In the Punjab Asylum on March 31, 1906, out of 121 criminal insanes 81, or 77 per cent., had killed their fellow-men, while of 351 male criminal insanes treated in the Berhampore Asylum in 1907, 132 were murderers, 9 had attempted murder, 43 had performed acts of grievous hurt with more or less homicidal intent, one had attempted murder as well as suicide, while only ten had attempted suicide. The small number of suicides is not to be surprised at, for the common methods of suicide in this country, viz. poisoning or drowning, are generally successful. Of the ten would-be suicides in Berhampore, five of them had attempted to cut their throats, and had been saved by prompt treatment. The total number of criminal insanes in Berhampore is absurdly large, and is due to the inclusion of a number of perfectly harmless village fools and idiots who have been charged with trivial crimes, such as travelling without railway tickets, petty thefts, house-trespass, and even begging. Of the 351 criminal insanes treated at Berhampore in 1907, only 216 would fall into this category in England. Steps are being taken to transfer the harmless criminal insanes to the civil divisions of asylums, and instructions are being issued to magisterial officers regarding the disposal of harmless insane persons charged with minor offences.

Case.—**Epileptic insanity,** with marked suicidal and homicidal impulse.—Gajabir Limbu, a Nepali, admitted from Darjeeling in 1901, at the age of 28. He had previously served in the Burma Military Police and had been discharged on account of epilepsy. One day, in 1900, at Darjeeling, he suddenly ran 'amok,' killing his cousin, several goats, and fowls with a kukri before he was secured. Since admission he has suffered from epilepsy, the seizures occurring at long intervals. He is unusually silent prior to a fit, and is extremely irritable and dangerously excited after one. At all times he is a man liable to attack suddenly, without motive or provocation, any one who may be near him. He requires to be constantly watched. During 1901 and 1902, after admission, he was more suicidally than homicidally inclined, and he made three determined attempts to end his life. On September 26, 1901, he cut his throat with a piece of tin, partially severing the trachea. On January 13, 1902, he attempted to wound his neck with a pointed bamboo, and on the 15th of May following he tried to strangle himself. Since then, however, the tendency to self-destruction has been less prominent.

Case.—**Chronic mania with homicidal impulse.**—Gopi Bhuia, a Hindu (Kaibarta) from Midnapore, admitted on February 24, 1902, having been indicted for murder but unable to stand his trial on account of his insanity. He is said to have been regarded as weak-minded from infancy, and to have some years prior to admission become addicted to ganja smoking which made him thoroughly insane. He has continued since admission in a state of restless noisy excitement. His speech is mostly foul abuse and is very incoherent. His memory is defective and his intelligence is that of a child. He is extremely liable to make sudden aggressive attacks and has frequently done so. On December 30, 1902, he rushed up to and killed an unfortunate fellow-patient before he could be restrained. He is the most dangerous insane in the asylum and his treatment is a matter of very great difficulty.—C. J. R. Milne, 1908.

In some cases the insane propensity appears to be of gradual growth (see *Case*, p. 358); in others, previous to the commission of the act, the individual shows symptoms (perhaps only slight symptoms) of the existence of eccentricities (see *Cases*, pp. 371 and 379), mental disorder (see *Case*, p. 383), and it has been noticed that homicidal tendencies may coexist with a quiet exterior. In other cases, again, the homicidal act appears to be the result of a sudden and uncontrollable impulse, occurring in an apparently sane person, the commission of the act being, as it were, the only symptom of insanity exhibited, as in cases of running amok. Not infrequently the homicidal propensity of impulse appears to be connected with disordered menstruation, or with parturition, puerperal fever or with epilepsy. Not infrequently, also, it is accompanied by suicidal tendencies. Especially in cases where the symptoms of insanity are slight, importance attaches to the character of the act.

Running amok.—The word **amok** is a Malay word meaning, literally, 'frenzied.' But it is applied to the impulsive form of

reckless multiple homicide often without motive. In India it is usually associated with the delirious intoxication of Indian hemp, and is most prevalent amongst Mohammedans. In the Malay Archipelago it appears to occur independently of drug intoxication. Dr. Gimlette [1] considers the Malayan form to be pathological and allied to somnambulism, the individual being rendered "subconscious by the unrestrained action of his own automatic centres," and in some respects allied to the 'procursive' form of epilepsy in which the patient starts to run. There is always, says he, (1) sudden paroxysmal homicide, generally in the male, with evident loss of self-control; (2) it is preceded by a period of mental depression; (3) there is a fixed idea to persist in reckless killing, due to an irresistible impulse of a purposive character; (4) there is a subsequent loss of memory. Another Malay observer [2] divided *amok* into two classes: (1) cases where the motive is revenge for a supposed or real wrong, where the assailant becomes perfectly reckless; and (2) what he describes as *orang beramok*, which requires the intervention of the medical jurist to prevent irresponsible persons suffering from the penalty of the law. As the first persons injured are sometimes strangers with whom the accused is not at enmity, and whom he could have no motive in killing, the mental condition of the *amok* murderer should be subjected to prolonged medical observation with reference to the question of responsibility.

Case.—**Homicidal mania by cutting.**—This man, an inmate of Lahore Asylum, has for fourteen years been constantly possessed with the desire to kill by cutting. No family history of any kind is available of a reliable nature. At the age of 32 there is a doubtful history of his having been for three months strange and altered, given to cursing God and the Prophet, with delusions of exaltations, saying that he himself was a prophet. Following this it was noticed that he had become more irritable and quarrelsome, but this disappeared, and he was thought to be perfectly sane and normal. He is a barber: a friend of the family used to come daily to sit in his shop, and arrived as usual on the 3rd July, 1887, when quietly, without any warning or provocation, our patient came up behind him and cut his throat with his razor. Since that time up to 1900, when he was transferred here, he had been confined in jail as a criminal lunatic. He is and always has been a quiet well-behaved man, speaking calmly and sensibly without the slightest of the usual signs of insanity, clean, decent, intelligent, without delusions or hallucinations, although a fluent liar and a very plausible speaker; but he is, notwithstanding, always trying to secrete knives or sharp pieces of tin, and with these make a murderous attack on some one, his own desire, which he seems quite unable to combat, being to kill by cutting some fellow-creature. In June, 1900, he somehow managed to get possession of a razor, and without provocation made a murderous attack on a fellow-prisoner. On 30th

[1] Med. Archives, Federated Malay States, 1901.
[2] Dr. Oxley, in 1843, quoted by Chevers.

October, 1901, he secreted a piece of iron hoop, and with this unsuccessfully attempted to cut another lunatic's nose off. Since then, with stringent supervision, he has failed to obtain means to effect his purpose, and has remained the same quiet, intelligent, well-behaved man he has always been for the last fourteen years.—G. F. W. Ewens, *Ind. Med. Gaz.*, 1902, p. 228.

The chief points usually stated to indicate homicide by an insane are :—

(*a*) **The absence of motive.**—*Case.* below is an example of this. Sometimes there is not only an entire absence of motive, but, as pointed out by Taylor, the act is done "in opposition to all human motives." A woman, for example, murders her own children, or a man known to be fondly attached to his wife, kills her. Caution, however, is necessary in judging from this character. In a murder by a sane person there may be an apparent absence of motive, simply because the motive has not been discovered. On the other hand, in cases of homicide by undoubtedly insane persons, a motive—often, it is true, incommensurate with the act—has existed, or has appeared to exist. Again, in cases of homicide by sane persons, especially in India, the motive leading to the crime is sometimes a very trivial one.

(*b*) **The absence of concealment** of the act.—*Case* below affords example of this. On the other hand, there is sometimes a considerable effort at concealment of homicide by an insane.

Case.—**Homicidal mania** in an individual otherwise apparently sane.—"William Brown strangled a child whom he met by accident, and then requested to be taken into custody. On the trial he said he had never seen the child before, and had no malice against it, and could assign no motive for the dreadful act. He bore an exemplary character, and had never been suspected of being insane."—Guy's *Factors of Unsound Mind*, p. 181.

(*c*) **The absence of accomplices.**—This character is often present in homicide by sane persons. The existence, however, of accomplices strongly indicates sanity.

(*d*) **Numerous murders committed at the same time.**—Little reliance can, however, be placed on this character. In homicide by insanes there is often only a single victim (see *Cases*, pp. 368, 373 (*c*), and 383). On the other hand, in homicide by sane persons, there are sometimes numerous victims, as in 'Running amok' (p. 383).

Absence of elaborate premeditation.—To this, however, there may be exceptions.

Case.—**Homicidal mania with elaborate premeditation** under 'purity' hallucination.—Bertha Peterson, aged 45, daughter of the Rector of Biddenden, was indicted for the murder of John Whibley. The deceased,

a shoemaker, had been a teacher in the Sunday school of Biddenden, and there had been rumours eighteen months before the murder of his having behaved indecently towards a little girl of eleven. The prisoner was much interested in the rumour, was a disciple of Mr. Stead, took a great interest in the Criminal Law Amendment Act, and appears to have allowed her attention to be absorbed by these subjects until she became even more crazy than the general run of the nasty-minded apostles of purity. She purchased a revolver and practised with it. She wrote to the deceased, expressing her regret for the mistaken attitude she had adopted towards him, and asking him to meet her in the parish schoolroom in the presence of witnesses and shake hands as a token of forgiveness. The meeting took place, and then, asking deceased to take a good look at a picture on the wall, she placed a revolver to the back of his head and shot him dead. Evidence was given of various eccentricities in the previous conduct of the prisoner, and Dr. Davies, superintendent of the Kent County Asylum, and Dr. Hoare, surgeon to the Maidstone Jail, in which the prisoner had been detained pending her trial, stated that in their opinion the prisoner was under the hallucination that she was ordered to shoot the man. At this point the judge interposed and invited the jury to stop the case. The jury preferred to hear the commencement of the speech for the defence, but before its conclusion they returned a verdict of "guilty, but insane."

This case shows the exaggerated effect that any emotional propaganda may have upon persons of unstable brain. The unfortunate woman's mind was obsessed by the pseudo-revelations of Mr. Stead's pornography, and her crime was the result of her obsession. The ease with which the plea of insanity was established is rather remarkable in consideration of the elaborate premeditation and contrivance exhibited. This case bears a striking relation to the Prendergast trial. The evidence of premeditation and adoption of means to ends shown by this unfortunate lunatic were of the same kind as those relied upon by the prosecution to prove the sanity and full responsibility of Richard Prendergast for the murder of Carter Harrison.—*Jour. Mental Sc.*, October, 1899.

Kleptomania, or the impulse to steal, is often present in general mental disease, though it is sometimes pleaded to excuse a theft by well-to-do people otherwise sane. In some cases theft committed by an insane is distinctly traceable to the existence of a delusion, *e.g.* the individual may believe that he is only recovering property stolen from him. This sometimes occurs as an outcome of the delusions of boundless wealth often present in incipient general paralysis. Or, again, the individual may believe that he has received a divine command to take possession of the articles he steals. In other cases, by no means common, there is no delusion, but simply a morbid propensity or uncontrollable impulse to steal or to acquire. Kleptomania is sometimes strikingly hereditary,[1] and it is alleged that it has often shown itself in women labouring under disordered menstruation, or far advanced in pregnancy.[2] Browne[3] goes at length into the characters which distinguish

[1] Bucknill and Tuke, *op. cit.*, p. 284.
[2] Marc and others, quoted by Taylor, *Man.*, p. 757.
[3] *Med. Jur. of Insanity*, p. 132.

theft by kleptomaniacs from theft by sane persons. A brief summary of these is as follows:—

(1) The articles stolen are such as the means of the individual would readily enable him to purchase (see *Case* (*a*) below) or are of little value. (2) Some kleptomaniacs steal openly, others willingly avow the act, or restore the goods stolen. Some, however, conceal the theft with much ingenuity. (3) Kleptomaniacs, as a rule, make no use of the articles stolen; they either throw them away or hoard them, and have no accomplices. (4) In many instances, but not invariably, the articles stolen are bright and glittering articles. *Case* (*a*) below, in which kleptomania was set up as a defence to a charge of theft, illustrates the points to be attended to in forming an opinion on cases in which it is alleged this form of insanity exists.

Case (*a*).—**Kleptomania.**—"Mr. M—— was an individual of high rank, the owner of an excellent estate, and was as wealthy as most of his neighbours in the county in which he resided. He was never suspected of being insane, and the only evidence of mental unsoundness that could have been obtained was a confession on the part of some of his servants that he was 'sometimes peculiar.' Yet this gentleman was in the habit of appropriating 'towels.' He invariably, when visiting or on a journey, packed the towels he found in his bedroom in his portmanteau. And when he returned home, the stolen articles were, by his own directions, returned to their real owners."—Browne, *op. cit.*, p. 128.

Case (*b*).—**Alleged kleptomania** (Casper, IV. p. 308).—Frau von X——, a lady of certain rank, committed during her pregnancy theft in three goldsmiths' shops. She concealed her conduct from her husband until she was summoned after her delivery, when she confessed to him her thefts, accounting for them by stating that during her pregnancy she had been seized with an irresistible desire to possess herself of glittering objects. She also said that she had gone out with the intention of returning the articles she had taken, but had become convinced by the way that they were her own property, properly acquired. Much evidence was given which went to show the existence of mental aberration. Casper, being referred to, gave it as his opinion that Frau von X—— was criminally responsible, that in fact in her case the propensity to acquire was not irresistible, and gave as reasons: "(1) That although the accused had besought her husband not to take her to those places where shining objects were to be seen, she went to goldsmiths' shops of her own accord, and without any necessity for doing so. (2) That she had paid away silver. (3) That she broke up the objects she stole in order that they might not be recognized, and in that way lead to her detection. (4) She had not gone to the same goldsmith's shop twice. (5) She had concealed her conduct from her husband; and (6) when interrogated she had made many false and contradictory statements."—Browne, *Med. Jur. of Insanity*, p. 138.

Incendiarism.—Cases of pyromania, or morbid propensity for incendiarism, sometimes occur. Young females suffering from disordered menstruation, or hysteria, or epilepsy are said to be specially liable to it.

Other forms of partial moral mania are erotomania, an uncontrollable craving for excessive sexual intercourse; it is called nymphomania in females and satyriasis in males: it may exist in the earlier stages of general paralysis and locomotor ataxia; and dipsomania, a morbid craving for intoxicants.

Examination of Alleged Insanes.

To ascertain the existence or otherwise of insanity you examine:—

1. **General appearance of patient.**—Especially: (*a*) any cranial deformity (see 'Amentia'); (*b*) the facial expression and gestures—these are often highly indicative of insanity, especially of its advanced or more fully developed forms; and (*c*) any peculiarities of dress, gait, or surroundings.

2. **Bodily condition.**—Note specially: (*a*) the condition of the digestive functions—these are often disordered in the early stages of insanity, the skin becoming harsh and dry; (*b*) the state of the pulse, and the presence or absence of febrile symptoms—this is important in distinguishing between insanity and the delirium of disease; and (*c*) the presence or absence of insomnia, restlessness, excitement, depression, or defect of speech or articulation. Bucknill and Tuke observe that in a great many cases of chronic mania the hair becomes rough and bristling. A blood tumour of the ear (hæmatoma) ending in shrivelling, the so-called asylum, or 'insane ear,' is often noticed in advanced cases.

3. **History.**—(1) As indicative of the cause of the disease. The existence or absence of (*a*) congenital defect, (*b*) hereditary taint, (*c*) habitual indulgence in intoxicants, (*d*) disorders, especially in females, of the reproductive organs, (*e*) epilepsy, or other brain affection or injury, (*f*) excessive sexual indulgence, and (*g*) mental overwork, anxiety, or sudden shock. Inquiry should also be made as to whether anything has occurred likely to induce the individual to feign insanity. It must not be forgotten, however, that sometimes insanity may arise from the anxiety of mind resulting from a criminal charge. (2) As to existence of the disease, it should be noted whether or no (*a*) there has been any previous attack of insanity; (*b*) there has been any marked alteration or change in the feelings, affections, and habits of the patient; and (*c*) inquiry should be made generally as to the symptoms observed at the commencement of the alleged outbreak of insanity.

Case.—**Insanity due to anxiety** of mind caused by a criminal charge.—A poor man, a shoemaker, was requested by two police-officers to assist them in conveying to prison two men committed on a charge of theft. The shoemaker took a gun with him, and on the order of the police-officers fired at one of the prisoners, who was attempting to escape, and wounded him severely. The shoemaker was committed to gaol as a criminal, and the event made "such an impression upon him that he became violently maniacal."—Taylor, *Med. Jur.*, II. p. 496.

4. **Mental condition and capacity.**—Inference as to this may be drawn from the patient's (1) answers to questions, (2) acts, and (3) writings. As regards (1), the patient's memory may first be tested. He may be asked, for example, his name, place of birth, as to the occupation of his parents, number of brothers and sisters or children, the date, the names of well-known persons, and may be asked to count in order from one upwards, etc. Next, his judgment may be tested; he may be asked to perform simple arithmetical operations, may be questioned as to his knowledge of the value of money, and generally as to the inferences he would draw from particular facts. While questioning him, his power of fixing his attention should be observed. Next the existence of delusions should be searched for: if these are known, the conversation should be led to them; if not, the conversation should be led to various topics in succession. Lastly, the state of the moral feelings should be inquired into by directing the conversation to the subject of the patient's friends and relatives. This testing of the mental capacity by questions is of special importance in cases of supposed feigned insanity. Except in complete amentia, advanced dementia, or possibly also in an actual paroxysm of maniacal excitement, in true insanes, consciousness, memory, and reasoning power, especially as regards matters unconnected with their delusions, remain, at any rate to a certain extent, intact. *Case* (*c*), p. 391 is an example of feigned insanity, detected by persistently silly and erroneous answers to simple questions. Care should be taken that the questions asked are not too complex, but are such as the individual under examination might reasonably, from his education and position, be expected to be able to answer.

Case (*a*).—**Mental Acuteness of "Lunatic."**—*Re Dinshaw*, Bombay High Court, Lt.-Col. C., I.M.S., in his certificate that D. was a lunatic gave as one of the "facts indicating insanity," "Although electric tramcars have been running in Bombay for two years, he has never travelled in one." The alleged lunatic, smiling, whispered to his counsel, who thereon asked the witness how often *he*, Colonel C., had been in a tramcar. The answer was, "Never!"

Case (*b*).—Ogston relates a similar case,[1] for example, in which a

[1] Case of David Yoolow, *Lect. Med. Jur.*, p. 297.

medical witness put forward as evidence of mental incapacity the fact that an alleged imbecile could not tell how much per cent. £20 interest on £1200 amounted to, though he himself (the witness), when asked to answer the same question, was unable to do so.

During the course of the examination, it should be noted whether the individual, as is usually the case with impostors, appears to be trying to make himself out to be mad. True insanes will often argue with considerable ability that they are not mad. Others are conscious of their condition. A constant putting forward, however, of evidence of insanity should always be looked on with suspicion.

(2) As to the evidence of mental disorder afforded by the *acts* of the patient, it should be recollected that these in a true insane are the results of his disordered mental condition. Where delusions exist, his acts and antics are connected with them, even although the connection may be apparently inexplicable (see *Case* (*a*)). Sometimes, as Dr. Guy remarks, "the acts of the maniac evince the same forethought and preparation as those of the sane" (see *Case* (*b*)); and lastly, true insanes are generally easily imposed upon.

Case (*a*).—**Acts apparently inexplicable the result of delusion.**—"I expected to be guided to prayer, but a spirit guided me and placed me in a chair in a constrained position, with my head turned to look at the clock, the hand of which I saw proceeding to the first quarter; I understood I was to leave the position when it came to the quarter. Another delusion I laboured under was that I should keep my head and heart together, and so serve the Lord, by throwing myself with precision and decision head over heels over every stile or gate I came to."—(Guy's *For. Med.*, p. 186; quotation from the Autobiography of a Religious Maniac.)

Case (*b*).—**Homicide by an insane; forethought and preparation shown.**—"A patient confined in the Manchester Lunatic Asylum had been cruelly treated by a keeper, and in revenge killed him. He related particulars of the transaction to Dr. Haslam with great calmness and self-possession. He said, 'The man whom I stabbed richly deserved it. He behaved to me with great violence and cruelty.' After detailing the treatment, he went on, 'I gave him warning, for I told his wife I would have justice of him. On her communicating this to him he came to me in a furious passion, threw me down, dragged me through the courtyard, thumped me on my breast, and confined me in a dark and damp cell. Not liking this situation, I was induced to play the hypocrite. I pretended extreme sorrow for having threatened him, and by an affectation of repentance, prevailed on him to release me. For several days I paid him great attention and lent him every assistance. He seemed much pleased with the flattery, and became very friendly in his behaviour towards me. Going one day in the kitchen, where his wife was busied, I saw a knife; this was too great a temptation to be resisted. I concealed it about my person and carried it with me. For some time afterwards the friendly intercourse was maintained between us; but as he was one day unlocking his garden door I seized the opportunity, and plunged the knife up to the hilt in his back.'"—Guy's *For. Med.*, p. 187.

Case (*c*).—**Feigned insanity—silly answers to questions.**—A widow, who had bought a house, and not liking it, wished to annul the contract, and feigned insanity. When asked to count, she did so thus: 1, 2, 4, 6, 7, 8, 10, 11, 13, etc. Asked how many fingers she had on each hand, she said "four." Asked how many two and two made, she said, "six." To some simple questions, such as—How many children have you? How long has your husband been dead? What did he die of? What is your daughter's name? What have you had to eat to-day? What is your clergyman's name?—she in each case gave an incorrect answer. To other simple questions, such as—What year is this? How long is it since Christmas? Where do you live? etc., her answer was, "I don't know." Asked what is the first commandment, she answered, "I am the Lord thy God." Asked what is the second, she gave the same answer; said she did not know the third and fourth. Asked the fifth, she said, "Thou shalt *not* honour thy father and mother."—Woodman and Tidy, *For. Med.*, p. 900, from the Berlin *Medical Zeitung*.

5. **Writings** of the patient frequently show evidence of the existence of mental disorder by the patient. These may exhibit incoherence, or betray the existence of delusions; but except in cases of approaching general paralysis, the legibility of the handwriting is not usually affected. Sometimes the approach of insanity is indicated by a person omitting words from his writings or spelling badly.

Feigned Insanity.

The chief points by which feigned insanity may be distinguished are:—

1. **Absence of characteristic facial expression.**—In insanity, especially in the fully developed forms usually feigned by impostors, the facial expression is characteristic. In feigned insanity, this characteristic facial expression is usually absent, or if present, is not persistent.

2. **Absence of bodily disorder.**—Bodily disorder is usually present in true, and absent in feigned insanity. The presence or absence of insomnia should specially be noted. True insanes sleep but little; impostors, exhausted by their exertions in feigning insanity, sleep soundly. Deafness and dumbness are sometimes feigned. These in true insanes are usually congenital; in feigned insanes they come on suddenly, and after the occurrence of an event likely to induce the individual to feign insanity.

3. **Sudden attack without sufficient cause.**—In true insanity, if the attack is sudden, inquiry will, as a rule, show a sufficient cause for the attack. Feigned insanity usually appears suddenly, without sufficient cause, and is generally traceable to a desire to escape punishment.

4. **Want of uniformity in the symptoms.**—In feigned insanity, the symptoms are, as a rule, not uniform with any distinct type of the true disease. The impostor, for example, mixes general mania with excitement, with advanced dementia, etc. That variation from distinct type is often present in a case of true insanity, should, however, be borne in mind.

5. **Persistent obtrusion of the symptoms.**—Impostors nearly always try to convince you that they are mad, putting forward evidence of their insanity, especially when they think they are under observation. The fact of being under observation makes little difference in the behaviour of a true insane.

In many cases, a satisfactory diagnosis between feigned and true insanity can only be arrived at by subjecting the patient to prolonged observation; but suspected lunatics cannot be detained under observation for more than fourteen days. It must not be forgotten also, that an expert witness, when called upon to give an opinion as to the mental capacity of an individual alleged to be insane, must be prepared, as in other cases, to state the grounds upon which his opinion is based.

Legal Aspects of Insanity.

In the present state of our knowledge, it does not appear to be possible to frame a thoroughly satisfactory definition of the term 'insanity.' One of the chief difficulties in the way of doing so lies in the fact that it is impossible to set up a standard of sanity. Any definition, for example, to the effect that insanity is mental imperfection, incapacity, or disorder, arising from certain causes, involves the setting up of such a standard. Such definitions, in fact, involve the necessity of our laying down a standard of mental perfection, capacity, or sanity, deviation from which shall be held to constitute insanity. Nor is the difficulty diminished by substituting for the term 'insanity,' other terms, such as 'unsoundness of mind,' 'mental aberration,' or 'mental alienation.' This difficulty of defining the conditions, however, is of comparatively little importance, for the reason that whenever a legal right, liability, or disability, arises out of the fact that an individual is insane, it does not arise simply out of the fact of the individual's insanity, but arises out of the fact that the individual, by reason of his insanity, is—or was, at a certain specified time—mentally incapacitated to a certain extent or degree. The degree of mental incapacity which must be proved to exist, in order to establish that such right, liability, or disability accrues, varies with the nature of the right, liability, or disability in question.

Hence, when in the course of an inquiry for medico-legal purposes, an individual's sanity or insanity comes into question, what was to be determined is not simply, is the individual insane, or was he insane, at a certain specified time? Were it so, a definition of insanity would be necessary.

What has really to be determined is—Is this individual or was this individual at a specified time, by reason of insanity, mentally incapacitated to a certain extent or degree? Such questions may arise in criminal cases, and also in civil cases. Again, also, the question frequently arises, whether or not the insanity of the individual is of such a nature as to justify his being placed in an asylum or under restraint.

Criminal Responsibility and the Plea of Insanity.

Every person is by law presumed to be of mental capacity sufficient to render him responsible for his acts. In criminal cases this presumption may be rebutted by proof that, at the time the act was done, the individual, by reason of unsoundness of mind, was mentally incapacitated to a certain defined extent or degree. The burden of proving this rests with those who assert it. The plea of insanity is often advanced dishonestly to escape from the legitimate punishment for their crime, or this plea is sometimes too easily accepted for sentimental reasons.

The verdicts passed on such occasions are "guilty" or "not guilty because of insanity," but a third verdict should be allowed, namely, "guilty, but insane."—Sir W. T. Gairdner, *B. Med. Assn.*, 1898.

We have now to consider what is this degree of mental incapacity, which must be proved before an individual will be held irresponsible, or entitled to an acquittal from the prescribed penalty of his crime on the ground of insanity.

The English law on this subject is to be found in the answers given in 1843, by the English judges, to certain questions propounded to them by the House of Lords.

These questions were put to the judges in consequence of the McNaughten case (see below). The object of these questions was to obtain an authoritative statement of the law for the future guidance of the courts, and the answers of the judges thereto have ever since been held to embody the law of England on the subject.

Case.—**The McNaughten case.**—In this case a man, named McNaughten, was tried for the murder of a Mr. Drummond, and acquitted on the ground of insanity. McNaughten was under a delusion that Drummond was one of a number of persons whom he believed to be

following him everywhere, blasting his character, and making his life wretched. Under the influence of this delusion he shot Drummond. McNaughten had transacted business a short time before the deed, and had shown no obvious symptoms of insanity in his ordinary discourse and conduct.—Maudsley, *Responsibility in Mental Disease*, p. 95.

These answers are also embodied in *s.* 84 of the Indian Penal Code, which constitutes the law of India on the subject of the criminal responsibility of insanes. This section is as follows: "Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." The effect of this section may be stated to be as follows: Suppose it to be proved that an individual has done an act which, were he sane, would be an offence—say, for example, A has killed B. Suppose, also, it to be proved that A at the time of killing B was insane. A would be entitled to an acquittal if he, at the time of killing B, was by reason of insanity mentally incapacitated to one or another of the following degrees:—

1. To such a degree as to render him "incapable of knowing the nature of the act"; as, for example, if A in killing B did so under the insane delusion that he was slaying a wild beast or breaking a jar; or

2. To such a degree as to render him incapable of knowing that he was "doing what is either wrong or contrary to law"; as, for example, if A at the time of killing B was under the insane delusion that B was attacking him (A) for the purpose of killing him; for in that case A's insanity would render him incapable of knowing that he was acting contrary to law, seeing that A, were his delusion true, would be justified by law in killing B.

On the other hand, A would not be entitled to an acquittal if all that was proved in regard to his insanity was that he killed B under the insane delusion that B had blasted his character; for in that case A, even were his delusion true, would not be justified by law in killing B; and would be presumed, the contrary not being shown, to know the nature of his act, and also that he was acting contrary to law.

Another point requiring consideration is as follows:—There is a general consensus of opinion among writers on insanity, 1st, that one effect of insanity may be a weakening of the affected individual's power of self-control; 2nd, that in some cases the power of self-control is totally lost, the result being the production of an uncontrollable impulse, *i.e.* an impulse which nothing short of mechanical restraint will control (*Case*, p. 383), to do certain acts; and 3rd, that such weakening or

total loss of the power of self-control may occur, both in insanity accompanied by delusions, and in insanity unaccompanied thereby. The question therefore arises:—Suppose A to have killed B, and the only thing proved about A's insanity is that, by reason of insanity, A's power of self-control was, at the time he killed B, weakened or entirely lost, what would be the legal effect ?

To this question it may be answered:—

1. That any weakening short of total loss of power of self-control would not entitle A to an acquittal, either under Indian or English law.

2. That, according to the Indian law, total loss of power of self-control would not entitle A to an acquital, except the court consider it proved that, by reason of such total loss, A at the time of doing the act was, in the words of the section, "incapable of knowing the nature of the act, or that he was doing what is either wrong or contrary to law."

3. As regards the law of England on this last point, Sir J. F. Stephen[1] states that it is doubtful whether or no an act is a crime if done under the following circumstances: by a person suffering from mental disease, who at the time of doing the act was by such disease totally prevented from controlling his own conduct.

Hence, in a case where the question of criminal responsibility is concerned, a medical witness should not simply direct his examination towards ascertaining whether the accused is insane or not. He should in addition endeavour to form an opinion as to whether, by reason of insanity, the accused is mentally incapacitated to the degree specified in *s.* 84 of the Penal Code. He must, however, recollect that the real question at issue is the mental state of the individual at the time he committed the act. Hence he must be prepared if called upon to give his opinion as to this, and, as in other cases, must also be prepared to state the grounds on which his opinion is based. It may happen that, in order to arrive at a correct opinion, he has to take into consideration not only (1) facts which he has himself observed, but also (2) circumstances which he has heard deposed to in evidence, or of which he has been informed. It is obvious, however, that any opinion based upon circumstances not within the knowledge of the witness is worthless, unless such circumstances are admitted or proved to be true in fact; and such opinion, therefore, should be given on the hypothesis that these circumstances really exist, and should be stated to depend on such hypothesis.

Nevertheless, it should be remembered that few insane

[1] *Digest of the Criminal Law*, p. 21.

persons are wholly irresponsible. The insane in their routine treatment in asylums are punished for fits of temper or committing nuisances by withdrawal of privileges such as stoppages of tobacco, forbidding him the weekly dance, or the infliction of pecuniary fines. The degrees and extent of immunity to be granted to an insane for his misdeeds have been thus formulated by Dr. Mercier:—

(1) All lunatics should be partially immune for all their misdeeds; (2) Every lunatic should be wholly immune for certain misdeeds; (3) Very few lunatics should be wholly immune for all misdeeds—corollary—the plea of insanity, if established, did not necessarily involve the total immunity of the accused from punishment; it did necessarily involve his partial immunity; and (4) that in order to establish the plea of insanity it was necessary to prove the existence in the accused of one or more of the following mental conditions:—(*a*) exonerating delusion; (*b*) such confusion of mind that the accused was incapable of appreciating, in their true relations, the circumstances under which the act was committed or the consequences of his act; (*c*) extreme inadequacy of motive; (*d*) extreme imprudence; and (*e*) the non-concurrence in the act of the volitional self. *Brit. Med. Assocn.*, 1898.

Case.—**Epilepsy plea not accepted as insanity in murder.**—In case of H. Perry, *alias* Becket, who murdered Mr. and Mrs. Cornish and their two daughters at Forest Gate in June, 1919, the Lord Chief Justice and Justices declined to accept the plea of insanity although the murderer was subject to fits of epilepsy.

Those who in a fit of intoxication by alcohol or drugs commit crime during their temporary mental aberration are not allowed the privileges of the plea of insanity.

Validity of Consent.

In certain cases the fact that an individual has given a valid consent to suffer what has been done to him, affects the question of the criminality of the doer. But by *s.* 90 of the Indian Penal Code a consent is invalid if given by a person who "from unsoundness of mind or intoxication, is unable to understand the nature and consequence of that to which he gives his consent." Hence, in certain cases, the question may arise whether a consent proved, or admitted to have been given, was or was not invalidated by the fact that at the time of giving it the giver was mentally incapacitated to the degree specified in this section.

This question may arise in rape cases, for the consent of a female to sexual intercourse may be invalid by reason of her insanity. By the law of India, proof of insanity to the degree above stated invalidates the consent. This is not so in England, where a female, even if she be insane to the degree specified in *s.* 90 of the Indian Penal Code, may yet be capable of giving

a consent to sexual intercourse, sufficient to exculpate an accused from a charge of rape, and reduce the offence committed to a misdemeanour (see 'Rape').

The same question may arise in cases where death or hurt has been caused. By the law of India, if a person over the age of eighteen suffers death or harm from an act done to him with his valid consent, the fact that he so consented may have the effect of reducing the offence committed from murder to culpable homicide not amounting to murder;[1] or may even, if the act be one coming under the description of *s.* 87 of the Code,[2] absolve the doer of the act from all criminality.

It should also be pointed out that, by *s.* 305 of the Indian Penal Code, *abetment of suicide* of "any person under eighteen years of age, any insane person, any delirious person, any idiot, or any person in a state of intoxication," is punishable with death or transportation for life, while the maximum punishment awardable for abetment of suicide of a person not coming under the above description is, by *s.* 306, ten years' imprisonment. The degree to which a person must be mentally incapacitated, to be an insane person within the meaning of *s.* 305, is not defined.

Capacity of an Accused to make his Defence.

In criminal cases the question may arise: Is, or is not, the accused "of unsound mind, and consequently incapable of making his defence?" (See *ss.* 464 and 465, Criminal Procedure Code.) Obviously in such cases an expert called upon to examine the accused should direct his examination, not simply to the question whether the individual is or is not insane, but to the question whether or no the individual is mentally incapacitated to the extent indicated in these sections.

Competency as a Witness.

In civil cases, the law of India on this subject is embodied in *s.* 118 of the Indian Evidence Act. The 'explanation' attached to this section is as follows:— .

"A lunatic is not incompetent to testify unless he is prevented by his lunacy from understanding the questions put to him and giving rational answers to them."

[1] Section 300, Exception 5, of the Indian Penal Code is as follows:— "Culpable homicide is not murder when the person whose death is caused, being above the age of eighteen years, suffers death or takes the risk of death with his own consent."

[2] Section 87: "Nothing which is not intended to cause death or grievous hurt, and which is not known by the doer to be likely to cause death or grievous hurt, is an offence by reason of any harm which it may cause, or be intended by the doer to cause, to any person above eighteen years of age, who has given consent, whether express or implied, to suffer that harm; or by reason of any harm which it may be known by the doer to be likely to cause to any such person who has consented to take the risk of that harm."

The 'competency' of a witness to testify is a matter quite distinct from the 'credibility' of his evidence. Hence it may be that a lunatic who has been declared by the court competent to testify, may give evidence which the other circumstances of the case may show ought not to be believed. As in the case of testamentary capacity, no amount of disease of the nervous system not affecting the mind renders an individual incompetent as a witness. Thus, by *s.* 119 of the same Act, "a witness who is unable to speak may give his evidence in any other manner in which he can make it intelligible, as by writing or by signs; but such writing must be written and the signs made in open court. Evidence so given shall be deemed to be oral evidence."

Testamentary Capacity.

By 'testamentary capacity' is meant capacity to make a valid will. To invalidate a will on the ground of the insanity of the testator, it must be proved that at the time the will was made, the testator was mentally incapacitated to a certain extent or degree. This degree may be defined to be that he either (1) did not know the nature of the act he was performing, or (2) was not fully aware of its consequences; or (3) has made a disposal of his property which he would not have made had his mind been sound, under the influence of a delusion, or of a disorder of the mind, perverting his affections, or sense of right[1] (see cases *Banks* v. *Goodfellow* and *Smee* v. *Smee*, noted below).

Case.—**Validity of will by insane.**—Cockburn, C.J., in delivering judgment in this case, said: "It is essential to the exercise of such a power that a testator should understand the nature of the act and its effects; shall understand the extent of the property of which he is disposing; shall be able to comprehend and appreciate the claims to which he ought to give effect; and, with a view to the latter object, that no disorder of the mind should poison his affections, pervert his sense of right, or prevent the exercise of the natural facilities; that no insane delusion shall influence his will in disposing of his property, and bring about a disposal of it which, if the mind had been sound, would not have been made." . . . "But when in result the jury are satisfied that the delusion has not affected the general faculties of the mind, and can have had no effect upon the will, we see no sufficient reason why the testator should be held to have lost his right to make a will, or why a will made under such circumstances should not be upheld." . . . "In the case before us two delusions disturbed the mind of the testator—the one, that he was pursued by spirits; the other, that a man long since dead came personally to molest him. Neither of these delusions—the dead

[1] Undue influence exerted on a person of feeble intellect may be held to render a will invalid, although the feebleness of intellect considered *per se* be insufficient to invalidate it.

man not having been in any way connected with him—had or could have had any influence upon him in disposing of his property. Under these circumstances, then, we see no ground for holding the will to be invalid."—*Banks* v. *Goodfellow*, L. R. 5 Q. B. 549; Browne, *op. cit.*, p. 191, and Maudsley, *Respons. in Mental Disease*, p. 117.

Case.—**Testamentary incapacity.**—In this case two wills were propounded, one made in 1859 and the other in 1867. By the first the testator left nearly the whole of his property to his wife absolutely. By the second he gave it her for her life or widowhood only, after which it was to go to the Corporation of Brighton for the purpose of forming a public library in the Royal Pavilion there. It was proved that at the time the wills were made the testator laboured under various delusions, the chief of which were that he was a son of George IV., that when he was born a large sum of money was placed in his father's hands in trust for him, and that his father had robbed him of part of this and had given it to his brothers. Sir James Hannen, in summing up the case to the jury, said: "You should specially bear in mind that any one who questions the validity of a will is entitled to put the person who alleges that it was made by a capable testator upon proof that he was of sound mind at the time of the execution. The burden of proof rests upon those who set up the will, and, *à fortiori*, when it has already appeared that there was in some particular undoubtedly unsoundness of mind, that burden is considerably increased. You have therefore to be satisfied, from the evidence which has been offered by those propounding the will of 1867 and the earlier will also, that the delusions under which the deceased laboured were of such a character that they could not reasonably be supposed to affect the disposition of his property. This is an extremely delicate and difficult investigation, and may be illustrated by reference to the physical world. There might be a little crack in some geological stratum of no importance in itself, and nothing more than a chink through which the water filters into the earth; but it might be shown that this flaw had a direct influence upon the volume, or colour, or chemical qualities of a stream that issued from the earth many miles away. So with the mind. Upon the surface all may be perfectly clear, and a man may be able to transact ordinary business or follow his professional calling, and yet there may be some idea through which, in the recesses of his mind, an influence is produced on his conduct in other matters." After pointing out that George IV. had taken a great interest in the town of Brighton, and that the testator was under the delusion that his brothers, by the fraud of his father, had been put in possession of two-thirds of his (the testator's) property, Sir James Hannen concluded thus: "It being conceded that the testator was undoubtedly of unsound mind, are you satisfied that when he made either of the wills he was capable of dealing with the subjects before him entirely free from the delusions under which he suffered? If the evidence does not satisfy you as to this, your verdict should be against the will." The jury found against both wills.—*Smee and Others* v. *The Corporation of Brighton*, L. R. 5 P. D., p. 84.

A person who is insane therefore may make a valid will provided, at the time of making it, he was not mentally incapacitated to the degree specified above (see *Case*, p. 398). A valid will may, of course, be made by a lunatic in a lucid interval. Obviously, however, the shorter the alleged lucid interval, the greater the caution which should be exercised in

accepting evidence of its having occurred. Mere eccentricity will not invalidate a will, nor will any disease of the nervous system not affecting the mind. For example, a person speechless and paralyzed from apoplexy may (his mind being unaffected) make a valid will. A medical man, in examining into the testamentary capacity of an individual, might ask him to repeat the principal provisions of his will, and explain their action. Ability to do so would show that the testator understood the nature, and was aware of the consequence, of the act he was performing. The existence of delusions, etc., likely to affect the provisions of the will should, of course, also be inquired into.

Capacity to manage Own Affairs.

When a person is alleged to be of unsound mind and incapable of managing his affairs, an inquiry into the truth of this allegation may, on proper application, be ordered by a court so empowered. On such incapacity being proved, the individual may be deprived of the control and management of his property,[1] and a person appointed to manage it for him. The courts are also empowered to make suitable provision for the protection[2] of the individual, *e.g.* by appointing a person to take care of him. Formerly in England the usual procedure in such cases was to order—under what is technically called a writ "*de lunatico inquirendo*"—an inquiry to take place before a "commission in lunacy"; lately, however, the proceedings have been much simplified. In India the conduct of proceedings of this nature is provided for by Act IV. of 1912.

In all such cases the question at issue is not simply, whether or not the individual is insane or sane, but whether or not he is mentally incapacitated to such a degree as to render him incapable of managing his affairs. That this is so must always be borne in mind while examining alleged insanes in these cases. No general rule can be laid down as to what should, in these cases, be held to constitute incapacity. Where doubt exists, it should be given in favour of sanity, *i.e.* in favour of the supposition, from which, if established, disability does not arise. It may, however, be pointed out:—

1. That in cases of complete amentia, advanced dementia, and general intellectual mania, the individual is obviously incapacitated.

2. That in partial intellectual mania, an individual may be

[1] Placed under 'interdiction' is the technical expression.

[2] Protection is distinct from restraint (see 'Imposition of Restraint,' p. 394).

incapacitated or not, according as to whether his delusion does or does not interfere with his capacity. For example, an individual may believe himself to be made of glass, and yet be perfectly competent to manage his affairs.

3. That in moral mania, especially partial moral mania, the mental disorder may well be of such a nature as not to interfere with the individual's capacity.

The cases which present most difficulty are usually cases of incomplete amentia, especially the less-developed form (moral imbecility). In such cases very great conflict of opinion often exists among the expert witnesses as to the individual mental condition and capacity. This was so in the Windham case, p. 360. Lastly, it may be remarked that defective memory arising from old age does not, *per se*, constitute incapacity. "A defective memory in an aged person, taken alone, proves nothing." [1]

Validity of Contracts.

It may be sought to invalidate a contract on the ground of the insanity of one of the parties thereto. To succeed, two things must be proved, namely: (1) That the insanity existed at the time the contract was entered into, and (2) that by reason of insanity the contracting party was then mentally incapacitated to a certain extent or degree, namely, that he was incapable of "understanding it, and of forming a rational judgment as to its effect upon his interests" (Indian Contracts Act [IX. of 1872], *s.* 12).

The law of England, however, makes certain exceptions to this general rule, namely: (1) an insane is "liable for the price of necessaries, *i.e.* goods suited to his rank and position, actually ordered and enjoyed by, and *bonâ fide* supplied to him"; [2] and (2) an executed contract will not be invalidated, especially if the parties cannot altogether be restored to their original position, provided the contract is a fair and reasonable one, and the other party thereto had no reason to suppose the individual to be insane at the time of making it.[3]

According to the law of England, marriage is a contract. Hence a marriage may be declared null and void on the ground of the insanity of one of the parties thereto at the time of entering into such contract. The degree of mental incapacity which must be proved in order to, *per se*, invalidate a marriage may be stated to be incapacity "to understand the nature of the contract and of the responsibilities and duties it creates" (see

[1] Judgment in *In re Toplis*, Taylor, *Med. Jur.*, II. 524.
[2] Browne, *Med. Jur. of Insanity*, p. 7.
[3] *Ib.*; *Molton* v. *Zamroux*, 4 Exch. 17.

case *D.* v. *D.*, below). Weakness of intellect coupled with undue influence has been held to be good ground for invalidating a marriage (see *Case* below); hence the suitability, or otherwise, of the marriage, may be one of the points for the consideration of the court.

Case.—**Question of insanity** in regard to validity of marriage.—In giving judgment in this case, Sir James Hannen said: "The question I have to determine is whether the respondent at the time of her marriage on the 28th October, 1882, was of sound mind, so as to be able to enter into the contract of matrimony. . . . I am of opinion that every case of this kind must be decided on its own facts. . . . I accept for the purposes of this case the definition (of soundness of mind) which has been substantially agreed upon by the counsel . . . namely, a capacity to understand the nature of the contract and the duties and responsibilities which it creates. It is to be observed, however, that this only conceals for a moment the difficulties of the inquiry, for we have still to determine the meaning to be attached to the word 'understand.' If I were to attempt to analyze this expression, I should encounter the same difficulties at some other stage of the investigation with reference to some other phrase, and I should still have to determine on the review of the whole facts, whether the respondent came up to the standard of sanity, which I must fix on in my own mind, though I may not be able to express it. I may say this much at the outset, that it appears to me that the contract of marriage is a very simple one, which does not require a high degree of intelligence to comprehend it. I agree with the Solicitor-General (for the plaintiff) that a mere comprehension of the meaning of the words of the promises exchanged is not sufficient. The mind of one of the parties may be capable of understanding the language used, but may yet be affected by such delusions, or other symptoms of insanity, as may satisfy the tribunal that there was not a real appreciation of the engagement entered into."—*D.* v. *D.*, otherwise M., *Times*, 11th March, 1885.

Case.—**Undue influence** on validity of marriage of an insane.—"In the suit for the dissolution of the marriage of the Earl of Portsmouth, on the ground that he was of weak, and afterwards of unsound mind, it was proved that his servants were his playfellows, and that he was fond of driving carts loaded with dung or hay, that he was occasionally extremely cruel to his horses and domestics, etc., etc. He was, although of age, in the hands of guardians. One of these, a solicitor, persuaded him to marry his daughter, without communicating with the relations or other guardians, and the marriage was afterwards declared void on account of the undue influence used."—Woodman and Tidy, *For. Med.*, p. 890, and Abercrombie, *Students' Guide to Med. Jur.*, p. 169.

Aphasia in relation to testamentary capacity.—The question whether a person suffering from aphasia is capable of making a will, will depend upon the particular case. Each case must be judged on its own merits.

It must be laid down as a general principle that no one could make a will who did not possess the power of understanding and producing language of some sort. In order to make a will it was necessary for an individual to be able to communicate to others by means of some form of language what he

would like to be done after his death. It would not be held to be a will if a person simply indicated by signs before he died that he wanted such a thing to be done, nor would it be held to be a will if a person gave directions by word of mouth. A person must be capable of understanding language, so that he knew either what he said or what was read to him. That implied that he could hear and understand words, if he could not read or understand pantomimic language, but if he could read and understand what he read, then it was not necessary for him to hear or understand pantomimic language. Given that a person understood what was in a document, it was not necessary that he should be able to speak in order that he might execute a testamentary deed. He might indicate what he wished by means of writing, or by pantomime, or in other ways. A complete case of auditory aphasia, which implied word deafness and word blindness, would be incapable of making a will, because, not being able to understand any form of language, he would, in all probability, not be able to communicate his wishes by producing any form of language. From a consideration of the whole subject he had come to the conclusion that organic disease of the brain might render a patient incapable of making a will, and that some forms of aphasia might be produced also as one of the symptoms of the organic disease; that some forms of aphasia might render a patient incapable of will making; that auditory aphasia, if well marked, would incapacitate a patient from will-making; and that some other forms of aphasia, such as pictorial word blindness, pictorial motor aphasia, and graphic aphasia, might render a patient incapable of making a will, although he was not necessarily mentally incapable.—Dr. W. Eider, *Brit. Med. Assocn.*, 1898.

Imposition of Restraint and Lunacy Certificates.

When an individual by reasons of unsoundness of mind is mentally incapacitated to a certain extent or degree, restraint may be lawfully imposed upon him. This restraint may be either immediate, or may be imposed (after certain conditions have been complied with), by relegation to an asylum. Hence in regard to the imposition of restraint, we have to consider three questions: (1) What degree of mental incapacity justifies the imposition of immediate restraint? (2) What degree of mental incapacity justifies the imposition of restraint by relegation of the individual to an asylum? and (3) What are the conditions which must be complied with before an insane person is relegated to an asylum?

Degree of Mental Incapacity justifying Immediate Restraint.

By the common law of England a person of unsound mind may be lawfully restrained from inflicting physical injury on himself or others. Restraint also, imposed in good faith on a person of unsound mind, for the purpose of preventing him from injuring himself, would come within the general exceptions of the Indian Penal Code, relating to acts done for a person's benefit (see *ss.* 89 and 92). Probably, also, these exceptions would be held to extend to such restraint as might be necessary to prevent an individual inflicting injury on others. Hence the degree of mental incapacity which, in a person of unsound mind, justifies the imposition of immediate restraint, is mental incapacity to an extent which renders him dangerous to himself or others. Immediate restraint can, however, only be lawfully imposed, either (*a*) with the consent of the person having lawful charge of the insane individual, or (*b*) without such consent if the circumstances of the case are such, that the consent cannot be obtained in time to prevent danger. Further, immediate restraint thus imposed is only lawful so long as the danger exists.

Imposition of immediate restraint is justifiable also, under similar conditions, in case of delirium from disease, *e.g.* delirium tremens. In imposing immediate restraint in cases of delirium from disease, a medical man must recollect that, from the nature of the case, the danger is liable to cease suddenly, and that restraint continued after danger has ceased may be a ground of action against him.

Degree of Mental Incapacity justifying sending to an Asylum.

By the law of both India and England, a medical man in relegating an insane person to an asylum, must certify that the individual is insane, and that he is "a proper person to be taken charge of and detained under care and treatment."

Obviously a proper person to be detained under care in an asylum is one, who being insane,[1] is dangerous to himself or others, and medico-legal writers are agreed that this extends also to one who by reason of insanity is likely to injure his own property, or the property of others. Taylor[2] infers that

[1] Not simply suffering from delirium of disease, which renders him a fit subject for a hospital, not for an asylum.

[2] Taylor, *Manual*, p. 709.

relegation to an asylum simply for the purpose of treatment is not justifiable, but from the remarks of Lord Coleridge, C.J., in the case of *Neave* v. *Hatherley* (see below), it would appear that relegation to an asylum simply for the purposes of treatment is justifiable in cases where the circumstances are such that efficient treatment cannot be employed unless the individual is so relegated.

Case.—**Legal justification of restraint.**—In this case Lord Coleridge, C.J., said that the examination of a person previous to placing him in an asylum ought to be "a real inquiry, a real weighing and sifting of evidence, a real examination, a real serious and solemn exercise of judgment," in order to ascertain whether an individual came within the definition of the statute of "a lunatic, idiot, or person of unsound mind, and a proper person to be taken charge of and detained under treatment. He emphatically dissented from the Attorney-General (for the plaintiff), that unless every other means had first been exhausted a person ought not to be placed in an asylum. The abuse of a thing was no proof that it had not a use, and early treatment in cases of unsoundness of mind was of the very greatest importance. People living in small houses had no power of making provision for such early treatment of relations who might be unsound in mind, while relegation, at an early stage, to a well-appointed asylum was calculated to have the best results."—*Neave* v. *Hatherley*, Q. B. D., *Times*, 3rd August, 1885.

It may further be pointed out that when restraint by relegation to an asylum has been lawfully imposed, the responsibility for alleged unnecessary continuance of such restraint, no longer rests with the medical practitioner under whose certificate the restraint was originally imposed.

Admission to Asylums in India.

When a medical practitioner finds that a patient is suffering from insanity and is satisfied he should be sent to an asylum either for treatment or to prevent him injuring himself or others, or perhaps to prevent him destroying property or squandering his estate, it is important the practitioner should know what steps to take. The doctor is also frequently asked by the relatives or friends of a lunatic what steps they must take to have him admitted to an asylum. It will not add to his professional reputation if he has to admit he does not know, or if the instructions he gives are incorrect. In the case of a private patient in India the following is the procedure:—

After consulting the relatives as soon as the practitioner is satisfied from personal observation that the patient is a lunatic and a proper person to be taken care of, and detained in an asylum, he draws up a certificate, "Form 3" (see Appendix).

(*a*) Note particularly that his examination must be made and his opinion formed *separately from any other practitioner.*

(*b*) Note the words, "FACTS indicating insanity observed by myself," and be careful not to enter here anything but facts, and only those you have personally observed. Then advise the relation to call in another practitioner—either you or he must be a gazetted medical officer in the service of Government—to draw up a certificate of insanity on another "Form 3."

The relative, if possible the husband or wife, must obtain Form 1, an "Application for Reception Order" (see Appendix), and correctly fill it in and the attached "Statement of Particulars."

If there be no near relative, or if the near relatives be under the age of majority, some friend may fill up the "Application," stating the reason why the nearest relative has not done so.

A letter or telegram should as soon as possible be sent to the superintendent of the asylum to which it is desired to admit the lunatic, asking if he has accommodation, specifying what scale of accommodation is desired. It is well also to indicate the nature of the insanity, such as a "docile idiot," a "homicidal maniac," a "suicidal melancholic," etc.

The relative, or, in his default, the friend or guardian, then takes to an authorized magistrate—

1. The lunatic.
2. The Form of Application.
3. The two medical certificates, Form 3 (one must be given by a gazetted officer).
4. The answer of the superintendent of the asylum.[1]

[1] (1) This is not necessary in the case of "a lunatic who is dangerous and unfit to be at large," but many magistrates adjourn the case till they have information that accommodation is available. This involves delay and a second attendance in court. If the delay involve "more than seven clear days" between the medical examination and the presentation of the petition, the certificates become invalid. New examinations have to be made involving fresh fees to the examiners and loss of time to all concerned.

(2) In the case of a European soldier the Order for Reception is issued by an Administrative Medical Officer.

(3) In the case of a person "wandering at large" any police officer, not below the rank of an Inspector, or who is in charge of a police station, who has reason to believe such person is a lunatic, MAY arrest him.

(4) Or if he has reason to believe he is dangerous by reason of lunacy, he SHALL arrest him and have him placed forthwith before a magistrate. The Commissioners of Police are magistrates for this purpose.

If the magistrate considers there are grounds for proceeding further he may order the detention of the alleged lunatic for a period not exceeding ten days to enable a medical officer to determine if the person is certifiable. In this case the magistrate can make a Reception Order for the admission of the lunatic to an asylum on receipt of a single medical certificate, Form 3.

No "Form of Application" (Form 1) is necessary in this case. Instead of a "Statement of Particulars," an analogous "Medical History Sheet" is drawn up partly by the police, partly by the medical officer.

If ten days be not long enough for the medical officer to make his diagnosis, the magistrate may authorize further detention of the alleged lunatic for periods not exceeding ten days at a time, up to a total period of thirty days from the date on which he was first brought to the magistrate.

5. A certificate from a medical man to the effect that the lunatic "is in a fit physical condition to travel to the asylum."

If the lunatic be violent or obstreperous or in such a condition that the visit to the magistrate is likely to be harmful or inadvisable, the magistrate can, and should, if satisfied with the evidence, dispense with the lunatic's personal attendance.

Note.—The Act distinctly orders "The petition shall be considered in private." Chap. II., para. 9. Many magistrates are in the habit of holding the inquiry in open court to the great confusion and humiliation of the relations. This frequently leads to painful exhibitions on the part of female lunatics before a ribald audience, and should never be permitted.

According as the magistrate is satisfied or not with the evidence he either issues an "Order for Reception" into the asylum or dismisses the petition.

Safeguard to preserve Liberty of Non-Insanes.

In England, France, Germany or Austria, it is a *criminal offence* for any officer of an asylum, or any one in any way in partnership or relationship by blood or otherwise with such an officer, or person having any pecuniary interest or whose relation or partner has any interest in such an asylum to sign a certificate of lunacy.

In India, though no legal offence, it is extremely undesirable that certificates (Form 3) should be given by an officer of an asylum when any other gazetted officer is available.

The principle which underlies the European law is that should any certifying medical man through carelessness, ignorance, error in judgment or diagnosis, through corruption or through the machinations of designing persons, intentionally or accidentally give a certificate which deprives an individual of his liberty, immediately after admission his diagnosis is subject to the criticism and observation of the expert officers of the asylum, who thus constitute a veritable "Court of Appeal," and will without unnecessary delay rectify the error of the certifying practitioner.

If, however, the certifying surgeons be one or both, also the officers of the asylum, it is certain that if they have acted through malice or corruption they will not correct their offence till obliged to do so. Such a possibility is remote, but the Indian law should take the same safeguards as the law in other countries.

If their certificates be based on careless observation, or on errors in diagnosis, only a man of absolute probity could be

expected to correct his error by getting the patient discharged forthwith. The average individual might be inclined to postpone the correction of his mistake for some time "to save his face."

Some years ago an inquiry showed that of a total of 58 inmates of an asylum, 56 were admitted on the certificate of the superintendent, the second certificate being in many cases signed by his assistant. This asylum was situated in a city having at least a hundred medical practitioners, and a dozen gazetted officers.

Serious Obligations on Filling up Lunacy Certificates.

From the above considerations it is evident that even examining a patient previous to filling up and signing such a certificate, a medical man is bound to exercise extreme care. The social stigma which attaches to any person who has been detained in an asylum is a terrible infliction to a sensitive mind, and makes it necessary that no case should ever be sent there without due cause, and that every safeguard should be taken to prevent the possibility of a sane person being incarcerated in an asylum. As remarked by Lord Coleridge, his examination should be a "real inquiry, a real weighing and sifting of evidence, a real serious and solemn exercise of judgment." Negligence or want of care on his part (not simply an error in judgment) renders him liable to be cast in damages, on an action being brought against him (see *Hall* v. *Semple*, below). Obviously, a medical man, unless he has himself observed facts indicating insanity in the patient, is not justified in signing such a certificate; for to rely solely on the statements of others in such a case amounts to culpable negligence.

Case.—**Negligence in filling up a certificate of lunacy**—heavy damages (*Hall* v. *Semple*, 3 F. & F. 337).—In this case the plaintiff had been discharged from an asylum on the ground of informality in the certificate. This certificate was dated July 29, but the visit and examination were made on June 13. The defendant was one of the medical men who had signed a certificate of the plaintiff's insanity. The evidence, however, went to show that Hall, although a very bad-tempered man, was not really insane, and that the defendant had relied too much on the statements of the wife and other interested persons. Compton, J., in summing up the case to the jury, said: "The principal questions to which I desire to direct your attention are these: first, whether you think that he (the defendant) signed the certificate untrue in fact, negligently and improperly, and without making proper and sufficient inquiries. It will be for your consideration what degree of care is necessary, so as to make out by the absence of it culpable negligence. It is not a mere mistake or error in judgment which would amount to such negligence, but you must be satisfied that there was culpable negligence. . . . And, again, you are

not inquiring into an error in judgment, but whether the defendant has been guilty of that culpable negligence which I have explained and described to you—negligence in not making sufficient inquiries, the examination not having been sufficient in his own judgment." The jury found that there had been culpable negligence, and awarded the plaintiff £150 damages.

Further, the facts relied on and embodied in the certificate as facts indicating insanity must be facts which really do so. Numerous instances are quoted by Taylor,[1] on the authority of Dr. Millar, of certificates filled up with facts other than "good facts," or facts really indicating insanity. Some of these consist of mere statements of the existence of peculiarities of appearance or temper, not of themselves sufficient to show the existence of insanity, *e.g.* Has an insane appearance, or is violent in temper and very abusive, or refuses to take medicine. Others, again, are statements either to the effect that the individual labours under delusions, without specifying precisely what these delusions are; or statements to the effect that the individual labours under a particular belief, such as from its nature may possibly be true, unaccompanied by any definite statement to the effect that such belief has been inquired into and found to be untrue. A fact to be a good fact really indicating insanity, must either clearly show the existence of a delusion, or the existence of such conduct as cannot be accounted for on the supposition of sanity.

All the asylums in India are (1914) Government institutions, although the law permits of licensed private asylums. Private patients may be (1) Voluntary Boarders, (2) Patients admitted be "Reception Order on Petition," and (3) Patients committed by Presidency High Court or District Court after inquisition.

The following list of the present Government asylums in India may be useful for reference—

In BENGAL PRESIDENCY, (1) Bhowanipore; (2) Berhampur Central; (3) Patna. In ASSAM, (1) Dacca; (2) Tezpur. In BIHAR and ORISSA, Patna. In UNITED PROVINCES, (1) Agra Central Asylum; (2) Bareilly; (3) Benares. In the PANJAB, Lahore Central. In BURMA, (1) Rangoon Central; (2) Minhi. In MADRAS PRESIDENCY, (1) Madras Central; (2) Calicut; (3) Vizagapatam. In BOMBAY PRESIDENCY, (1) Naupada Thana; (2) Colaba; (3) Ratnagiri; (4) Ahmedabad; (5) Hyderabad (Sind); (6) Dharwar. In the CENTRAL PROVINCES, (1) Nagpur; (2) Jabbalpur. Of these only Bhowanipur, Agra, Lahore, Rangoon, Madras, and Yerrowda admit Europeans.

With the admission of the lunatic into the asylum the

[1] Taylor, *Med. Jur.*, II. p. 512.

responsibility of the medical jurist ceases. The question as to the care and the ultimate release or otherwise of the lunatic rests with the asylum authorities.

Specimens of the necessary forms are given in Appendix XI.; for further particulars regarding admission to and detention in Indian asylums of private and public patients, the "Indian Lunacy Manual of 1913," by Major R. Bryson, should be consulted.

CHAPTER XIX.

LEPROSY IN RELATION TO THE LAW.

[By Arthur Powell,

Inspector of Lepers, Bombay.]

Although the Lepers Act was passed in the year 1898, and its provisions extend to the whole of British India, it does not come into force in any part thereof until the Local Government has declared it applicable thereto. The Act has gradually been put in force so that now there are few districts to which it does not apply.

The Act provides not only for the segregation and treatment of pauper lepers, but also for the control of lepers following certain callings. The object of law is to segregate such lepers as are capable of disseminating the contagion of leprosy and so protect the public.

A "leper" within the meaning of the Act is defined as "any person suffering from any variety of leprosy in whom the process of ulceration has commenced."

It will be readily seen that this definition is by no means scientific. The ulceration need not be leprous ulceration. Any form of ulcer, whether arising from trauma, such as abrasion or wound, from varicose veins, vaccination, etc., is sufficient to bring the leper within the Act. Further, the ulcer may have completely healed at the time when the leper is arrested.

Probably the most dangerous lepers are those in whose nasal secretion leprous bacilli are found by the million. The writer in such cases often fails to observe any ulceration. If he does not personally observe ulceration or scarring, he cannot certify the leper as a leper within the meaning of the Act.

Certain pathologists maintain that the presence of leprosy bacilli and leucocytes in the nasal secretion is sufficient evidence of "ulceration." If this be so they must include gonorrhœa and all catarrhal conditions under the heading of "ulceration."

Under the Act any police officer is empowered to arrest without warrant any person who appears to him to be a pauper leper.

A "pauper leper" is defined as a "leper (*a*) who publicly solicits alms or exposes or exhibits any sores, wounds, bodily ailment or deformity with the object of exciting charity or of obtaining alms, or

(*b*) who is at large without any visible means of subsistence."

A person so arrested must be taken without unnecessary delay before an Inspector of Lepers, who if he finds he is not a leper gives him a certificate to that effect and at once releases him.

If the Inspector finds the arrested person is a leper as defined by the Act, he gives a certificate to that effect. The leper is taken to an authorized magistrate, who, if satisfied with the evidence, commits him to an asylum to be detained.

The Act also gives the Local Government power to order that no leper within any gazetted area shall—

(*a*) Personally prepare for sale or sell any article of food or drink or any drugs or clothing intended for human use, or

(*b*) bathe, wash clothes or take water from any public well or tank, or

(*c*) drive, conduct, or ride in any public carriage plying for hire other than a railway carriage, or

(*d*) exercise any trade or calling which may by such notification be prohibited to lepers.

CHAPTER XX.

LIFE ASSURANCE.

Medical men are associated with life insurance companies as medical advisers or as medical examiners, in both of which capacities it is the duty of the physician to detect any unsatisfactory deviation from the normal standard of health of the applicant, and any attempt by the applicant to conceal any unsoundness, and to enable the company to appreciate the extent to which the unsoundness may shorten life.

Life assurance is a contract for the object of making provision for a family, or otherwise, through the premature death of the head of the house, or for borrowing money for commercial purposes, in which an individual enters into an agreement with a company to pay them each year he lives a certain fixed sum, or 'premium,' in return for which the company issue a 'Policy of Assurance,' or undertaking to pay a certain fixed sum on the death of the assured, whenever this may happen.

This is the simplest form of the agreement; variations, however, are frequently introduced. Thus the yearly premium may be made payable in monthly, quarterly, or half-yearly instalments; or the assurance may be effected for a term of years only, the liability of the company ceasing on the expiry of the stated term; or it may be arranged that the sum assured shall be paid on the assured attaining a certain age, 'Endowment assurance,' or at his death, whichever may first happen.

For a given sum, payable at death or at a fixed age, the yearly premium to be paid by the assured must obviously be more or less, according to his 'expectation of life,' that is, according to the number of years he may reasonably be expected to live.

An individual's expectation of life depends (1) on his age, and (2) on his freedom or otherwise from any special influence tending to shorten his life. If no such special influence exists, the individual's expectation is said to be normal. Hence

arises the general question, on the answer to which the ordinary scale of premium rates of assurance companies must obviously be based, namely—(1) What is the normal expectation of life at various ages? But an individual seeking to assure may be subject to some special influence tending to reduce his expectation of life, and hence two other questions arise, namely—(2) What are the special influences which tend to shorten life, and to what extent do they do so? and (3) How is the existence in any given case, of influences tending to shorten life ascertained?

The Normal Expectation of Life at Various Ages.

The expectation of life is calculated from the general death-rate which, being fairly well fixed in a country like England, gives a fairly fixed expectation of life for different ages amongst individuals subject to the same conditions as those to whom the statistics refer. The following is one of the most recently published tables showing the expectation of life for men in England.

Expectation of Life for Men in England.[1]

Completed age.	Years.	Completed age.	Years.	Completed age.	Years.	Completed age.	Years.
0	39·91	32	31·42	56	15·86	80	4·93
5	49·71	33	30·74	57	15·26	81	4·66
10	47·05	34	30·07	58	14·68	82	4·41
11	46·31	35	29·40	59	14·10	83	4·17
12	45·54	36	28·73	60	13·53	84	3·95
13	44·76	37	28·06	61	12·96	85	3·73
14	43·96	38	27·39	62	12·41	86	3·53
15	43·18	39	26·72	63	11·87	87	3·34
16	42·40	40	26·06	64	11·34	88	3·16
17	41·64	41	25·39	65	10·82	89	3·00
18	40·90	42	24·73	66	10·33	90	2·84
19	40·17	43	24·07	67	9·82	91	2·69
20	39·48	44	23·41	68	9·36	92	2·55
21	38·80	45	22·76	69	8·90	93	2·41
22	38·13	46	22·11	70	8·45	94	2·29
23	37·46	47	21·46	71	8·03	95	2·17
24	36·79	48	20·82	72	7·62	96	2·06
25	36·12	49	20·17	73	7·22	97	1·95
26	35·44	50	19·54	74	6·85	98	1·85
27	34·77	51	18·90	75	6·49	99	1·76
28	34·10	52	18·28	76	6·15		
29	33·43	53	17·67	77	5·82		
30	32·76	54	17·06	78	5·51		
31	32·09	55	16·45	79	5·21		

[1] From Bowne's *Manual*—English Experience, No. 3 Males.

These are actuarial facts, based on an enormous number of fixed data and worked out by mathematicians. And on such tables assurance companies base their ordinary British premium rates for assuring the lives of men resident in Great Britain whose expectation of life is normal. Some insurance companies allow a slightly higher estimate than in this table. Lives deviating from the normal standard of health are **'loaded'** with an extra premium if accepted.

PURE, OR 'UNLOADED,' 3 PER CENT. PREMIUMS.

The 'pure or unloaded 3 per cent. premium' is the sum which, if paid yearly during the period of expectation, will, at 3 per cent. interest, amount at the end of that period to the sum assured. Assurance offices, of course, add to the 'unloaded premium' a certain percentage to cover cost of management and profit.

Age.	Expectation of healthy male lives from experience of twenty life offices in England.	Unloaded 3 per cent. premium in sterling per £100 assured.	Unloaded 3 per cent. premium stated as percentage on the sum assured.
		£ s. d.	
20	42·06	1 8 7	1·430
25	38·44	1 12 6	1·625
30	34·68	1 17 7	1·880
35	31·03	2 3 10	2·190
40	27·40	2 11 9	2·588
45	23·79	3 2 3	3·112
50	20·31	3 16 0	3·800
55	16·93	4 14 6	4·725
60	13·83	5 19 9	5·988
65	11·01	7 14 8	7·705

For women in Europe the expectation of life is greater than for men by about three years all through, except during the child-bearing period, when it is somewhat less.

A rough rule for calculating the 'Expectation of Life' is:—Between the ages of 20 and 45 use the fixed number 96. Deduct the present age of the person from this number, and half the remainder gives his expectancy. Between 20 and 30 the result is a trifle below the average, and over 40 is slightly above. For estimating the expectancy of those over 45 take 90 as a fixed number, instead of 96 as before.

Another method which gives a slightly lower expectancy is to add to the actual age of the individual two-thirds of the difference between it and 80, a limit of life which is certainly more reasonable than that of 86.

Thus: deduct present age, 42 from 80, result 38; and two-thirds of this number, 25; the net result is the probable duration of life—67 years.

For India although no authentic official tables have yet been published showing the normal expectation of life amongst natives of India, owing to the Indian birth and death statistics

for native lives being still incomplete and untrustworthy, the latest results by the medical adviser of a large insurance company in India are summarised in Appendix XII. On the expectancy of native lives in India, as compared with European lives, another Indian insurance officer wrote:—

"For some years past I have had frequent opportunities of seeing the family life of Natives of the insuring class, having been frequently called into consultation at houses in the Native parts of Calcutta. I may state in general terms that in such houses there is an entire absence of all ordinary sanitary arrangements. In almost all houses that I have seen, even of the best class, there seems to be free communication with the sewers, and the smell of sewer gas is to be found in most of them. In fact, the adoption of underground sewers in Calcutta has introduced a new element of danger into Native houses, and were it not for the open character of Native houses, I am convinced that sewer-gas diseases would be more prevalent even than they are at present. Stinking drains in the lower parts of Native houses are the rule, and cholera and diphtheria are common diseases."

"Again, another well-known fact is that diabetes is a very common disease amongst middle-aged Natives who are in easy circumstances, in a ratio greatly in excess of that which obtains among Europeans. It is not so rapidly a fatal disease as in Europe, but it shortens life most assuredly." . . . "The same remarks apply to the poorer classes of Eurasians and Armenians and Jews who live under bad, insanitary conditions." . . . "I consider it my duty to express a most decided opinion that though the constitutions of healthy Natives may not be much inferior to the European standard, from a medical point of view, their habits, modes of life, and the insanitary conditions amidst which they live are most distinctly inferior to the European standard, and render them more liable to acute diseases, increasing the risk of assurance." [1]

The rates, however, at which one of the principal assurance companies in India assures healthy native lives, appear to correspond roughly to an expectation—between twenty and sixty—of two-fifths of the difference between ninety and the age: *e.g.* at age thirty the expectation apparently calculated on is about twenty-four years.

For European and Eurasian lives in India the expectation of life has been worked out in some detail (see Appendix XII., also the following table), from which the extent by which the expectation of healthy Europeans is reduced by residence in India may be arrived at approximately. The expectation shown in B, it will be observed, corresponds approximately to half the difference between the age and eighty-six (not two-thirds of the difference between the age and eighty).

TABLES OF EXPECTATION OF LIFE IN INDIA.

A. Table of expectation of life compiled by J. Westland, Esq., Beng. C.S., from the experience of the Bengal Uncovenanted Civil Service

[1] *Ind. Med. Gaz.*, 1889, p. 311.

Family Pension Fund; European and Eurasian lives; period of observation, 1837 to 1862. This is based wholly on Indian experience.

B. Table of expectation of life compiled by A. F. Cox, Esq., Mad. C.S., from the combined mortality statistics of the Bengal, Madras, and Bombay Civil Services; European lives only; periods of observation—Bengal, 1850 to 1872; Madras, 1790 to 1852; Bombay, 1790 to 1860; number of lives under observation—Bengal, 600 to 1200; Madras, 500; Bombay, 700. This is based on Indian experience up to the age of fifty. But see Appendix XII.

Age.	Expectation A.	Expectation B.	Age.	Expectation A.	Expectation B.	Age.	Expectation A.	Expectation B.
20	—	33·65	42	17·86	22·12	62	7·93	11·39
22	31·43	32·49	44	16·69	21·18	64	7·27	10·54
24	29·85	31·41	46	15·57	20·29	66	6·62	9·52
26	28·32	30·36	48	14·53	19·39	68	5·92	8·54
28	26·84	29·31	50	13·55	18·43	70	5·20	7·62
30	25·39	28·26	52	12·63	17·38	72	4·50	6·75
32	24·02	27·22	54	11·71	16·25	74	3·80	5·95
34	22·72	26·19	56	10·72	15·09	76	3·10	5·23
36	21·49	25·16	58	9·68	13·91	78	2·41	4·57
38	20·28	24·13	60	8·72	12·74	80	1·72	3·98
40	19·07	23·10						

Special Influences tending to Shorten Life.

When an individual who proposes to assure is found to be subject to a special influence tending to shorten life, an assurance company may either refuse altogether to undertake the risk or may agree to assure the life, charging an enhanced rate of premium or 'loading' as a compensation for the individual's diminished expectation. This enhanced rate may be charged in one or other of the following ways :—

1. According to a special table of rates fixed by the company for individuals subject to a particular influence, *e.g.* residence in a tropical climate.

2. The ordinary premium rate for an individual whose expectation of life is normal may be charged, plus a special additional rate, calculated either as a percentage on the sum assured or on the ordinary premium. This is the method commonly adopted when the influence reducing expectation is the individual's occupation.

3. By adding a certain number of years to the assured's age, and charging him, instead of the ordinary rate corresponding to his actual age, the ordinary rate for an individual so many years older. This is the plan generally followed when the influence reducing expectation is the existence of disease or of a predisposition to disease. It should be noted that when this

method is adopted the number of years to be added to the age must always be greater than the number of years by which it is estimated that the individual's expectation is reduced. A little consideration will show that, where normal formula is applicable, the addition must, in round numbers, be one and a half times the reduction of expectation, *i.e.* just so many years as will raise the assured's actual age to the age at which the reduced expectation exists.[1]

The special influences tending to shorten life may conveniently be considered under three heads, viz.: (1) External; (2) Hereditary; and (3) Acquired, personal influences.

1. External Influences.

The chief external influences likely to reduce expectation of life are (1) locality of residence and (2) occupation.

1. Residence in an unhealthy locality.—Practically, assurance companies may be said to recognize three classes of localities, viz. (1) specially unhealthy, (2) unhealthy, and (3) ordinary localities. The west coast of equatorial Africa is considered to belong to the first class, and companies will only assure lives resident there by special agreement and at a special rate. India and tropical countries generally are looked on as belonging to the second class. During time of residence in a locality of this second class, some companies charge, in addition to the ordinary premium, an extra rate, in some cases as much as $1\frac{1}{2}$ to 2 per cent. per annum on the sum assured. Many companies, however, publish a special table of rates for residence in India and the tropics. The rates shown in these tables vary considerably; approximately the amount by which they exceed the corresponding ordinary or English rates, ranges from $\frac{3}{4}$ to $2\frac{1}{4}$ per cent. per annum on the sum assured. In forming an estimate of an individual's expectation of life, it should not be forgotten that of a number of localities to which the same assurance office rate applies, some may be more unhealthy than others. Low-lying, marshy districts, for example, are more unhealthy than well-drained ones, and in England towns are, as a rule, less healthy than country districts. Thus Guy gives the expectation of life at thirty, for the whole of England, as 34·1 years. The records of benefit societies in rural districts, however, show an expectation of 38·4 years at the same age; while in Liverpool and Glasgow the expectation at thirty is respectively twenty-seven and twenty-five years.[2] In India, again, certain localities are well known to be more unhealthy than others.

2. Occupation.—The occupation of an individual may tend to reduce his expectation of life by exposing him to risk

[1] For more precise calculations a table of expectation of life must be employed thus: Find the expectation corresponding to the individual's actual age; from this deduct the number of years by which it is estimated his expectation has become reduced; then find in the table the age corresponding to the reduced expectation; the difference between this and the actual age is of course the number of years to be added.

[2] Guy, quoted by Sieveking, *Medical Adviser in Life Assurance*, p. 119.

of (1) mechanical injury, (2) absorption of poison, or (3) contraction of disease, or of a habit, tending to shorten life. For mortality in different trades see Appendix XIII.

1. **Mechanical injury.**—The chief occupations exposing to this risk are as follows: military and naval service. In war times extra rates of five to twenty guineas per cent. have been charged to officers actually engaged. During time of peace officers of the navy are usually charged an extra rate of half a guinea per cent. within certain limits, and a special higher rate beyond.[1] In India an extra charge of about 1½ per cent. per annum (which covers war risk in India) is usually made for military employ, engine-drivers, sailors, and miners. The usual extra charge for these occupations is 1 to 2 per cent. additional on the sum assured. Other occupations exposing to this risk, and for many of which extra rates are charged, are mining engineers and agents, makers of explosives, quarrymen and others using explosives, railway officials generally, policemen, firemen, gamekeepers, builders, plumbers, and glaziers, and all occupations involving constant contact with horses.

2. **Absorption of poison.**—This risk attends the manufacture of chemicals generally, and specially the manufacture of compounds of the more poisonous metals. Occupations involving constant contact with such metals or their compounds (*e.g.* arsenic, mercury, lead, and copper) are also exposed to it. Again, occupations involving exposure to poisonous vapours: *e.g.* phosphorus vapour, nitrous acid vapour, sewer gases, etc., involve this risk.

3. **Contraction of disease, or of a habit tending to shorten life.**—Occupations exposing to risks of this kind are (a^1) very dusty occupations, as grinders, millers, masons, and coal-miners; Sieveking remarks that few of the Sheffield steel grinders attain the age of thirty-five; (b^1) sedentary occupations, especially if carried on in badly ventilated rooms; (c^1) occupations likely to lead to the acquirement of habits of intemperance, *e.g.* publicans and others engaged in the manufacture or sale of alcoholic liquors. Sieveking[2] points out that while between the ages of forty-five and fifty-five the general mortality for all England is 18 per 1000, the rate between the same ages in the case of inn and beershop keepers is 28 per 1000, and in butchers (probably from the same cause) 23 per 1000. There is some reason also to suppose that much **railway travelling** injuriously affects health, and hence that occupations involving this tend to shorten life. It may also be noted that, according to Guy, the average duration of life among members of the learned professions is seventy-six years and six months, or greater than is the case in any other occupation.

2. Hereditary Influences.

1. The influence of the constitution of the parent on the life of the offspring may convey hereditary disease. The percentage of cases in which hereditary transmission of disease is traceable, is variously stated by different authorities. Much of this variation arises from difference in the fact accepted as showing hereditary transmission. Thus, if the only fact accepted as indicating this is affection of the parents, a lower percentage,

[1] Sieveking, *op. cit.*, p. 221.

[2] *Op. cit.*, p. 62.

of heredity will be found than when affection of the grandparents or any of their children is accepted. The following are the chief hereditary diseases, and the main facts derived from European experience, bearing on the question under consideration. Little or no information is available as regards hereditary transmission of disease among natives of India.

1. **Tubercle of the lung.**—The percentage of heredity of this disease is variously stated at 25 to 60 per cent. Females appear to be somewhat more liable to inherit it than males, and the disease seems to be more liable to descend from mother than from father to child. Sieveking considers that where the personal condition of the individual is good, the death from consumption of one parent, or of two of the individual's brothers or sisters, should be met by an addition of seven to ten years to the age; and that if both parents have died of the disease, the life should either be rejected altogether, or twenty to twenty-five years added to the age. Residence with or nursing of any one suffering from tubercle requires special loading.

2. **Gout.**—Percentage of heredity equals about 50. Sieveking states that the usual practice is to add three years to the age for hereditary liability to gout, but considers this addition inadequate.

3. **Cancer.**—Percentage of heredity, 8 to 33. Twice as many females as males die from this disease; hence the addition to age for hereditary liability to cancer should be greater in the case of females, as cancer is mainly a disease of later life.

4. **Rheumatism.**—Percentage of heredity, about 30. Acute rheumatism, although not so likely to prove directly fatal as other hereditary disease, may damage the heart and so impair expectation.

5. **Insanity, and brain disease generally.**—Percentage of heredity of insanity, 25 to 60. Hereditary transmission of insanity appears to be more common in the upper than in the lower classes of society, and to take place more frequently from mother to daughter than from father to son. Other brain diseases, *e.g.* epilepsy, exhibit a marked tendency to hereditary transmission, and frequently brain disease in one form in the parents is transmitted in another form to the children.

6. **Syphilis and scrofula.**—Hereditary transmission of these diseases is chiefly liable to affect the expectation of life of an adult indirectly, *e.g.* by rendering him less able to resist an attack of serious disease.

Heredity to long life.—Limited family vitality requires a substantial increase of premium.

The importance of heredity used to be exaggerated, says Sir William Gairdner, but the tendency now was too much the other way, partly in consequence of the discovery of the tubercular bacillus and the difficulty of reconciling that with the doctrine of heredity. It was the fashion nowadays to regard heredity as a misapprehension or a superstition. After all had been done, however, it could not be denied that the simple fact of long life or short life was in many cases a hereditary fact. Looking back over three or four or five generations in families known to be long-lived, you will see if many of the members had not even approached being centenarians. The opposite peculiarity was equally notable in short-lived families. Then there are the cases of families, among the members of which tubercular disease was rampant, and not only tubercular disease, but tubercular disease which killed at a particular age or within particular limits.

Indirect hereditary influences.—Great disparity of age (and, according to some, near consanguinity) between the parents, or extreme youth of the mother, may exert an indirect injurious effect on an individual's expectation of life by interfering with his development or power of resisting attacks of disease. Under the head of indirect hereditary influence the influence of sex on expectation may also be considered.

The general expectation of life among females is slightly greater than among males. Females, however, are subject to the special risk attendant on child-bearing. The risk does not attach to the pregnant condition, but to parturition, and attaches specially to a first delivery. Dr. Allen's statistics, collected from various sources, give as the proportion of deaths (from puerperal causes) to deliveries one in sixty-two for primiparæ and one in one hundred and twenty-four for multiparæ. Females, therefore, pregnant for the first time, Sieveking advises,[1] should be charged a special rate, and it is a question whether an extra rate should not also be charged to multiparæ. Such extra rates may be remitted when parturition has taken place or the period of child-bearing has come to an end. Frequent previous miscarriages often indicate a syphilitic taint, and justify an extra rate being charged, no matter what may be their alleged cause. Hereditary tendency to apoplexy, cancer or other diseases usually coming on late in life, may be dealt with by declining a whole-term policy and granting at ordinary rates an endowment policy payable at death or the age of 55, 60 or such age as will reduce the risk.

3. Acquired Personal Influences.

1. **A previous attack** of disease may be deemed to have reduced expectation. If the disease is (1) serious in nature and likely to recur, *e.g.* cancer, apoplexy, epilepsy, gout, etc.; or (2) likely to have impaired the functions of some important organ, *e.g.* sunstroke, acute rheumatism, dysentery, etc.; or (3) one indicating serious constitutional taint or impairment of function, *e g.* fistula, piles,[2] etc.

[1] *Op. cit.*, p. 75, "The older the primipara the heavier should be the rate, the mortality increasing after 50 years of age, a hereditary history of cancer could be ignored in endowment assurance maturing at the age of 45 or 50, whilst it should carry extra rates for a *whole* life policy."

[2] Powell and Manson have definitely demonstrated that the life-span of the guinea-worm in its human host averages about one year—from nine to sixteen months. If, therefore, a person has left a district in which he once or many times contracted guinea-worm and has resided in a place free from infection for a year and a half previous to the time of examination, no extra need be imposed.

In some cases the expectation may be deemed to be so greatly reduced as to render the life uninsurable. In other cases the reduction of expectation may be met by an addition to the age. No general rules can be laid down applicable to all cases as to the course which should be followed. Sieveking, however, states that a single, well-marked attack of acute rheumatism, confining the individual to bed for six weeks or more, justifies an addition of seven to ten years to the age, and that the addition should be greater if there has been a recurrence of the disease. The same authority also considers the usual deduction of three years from expectation for an attack of gout too little.[1]

2. **Acquirement of a particular habit.**—The habit reducing expectation, most commonly coming under notice, is intemperance. Intemperate habits, according to Mr. Neison, reduce expectation so greatly as to bring it down (in the middle ages of life) to about $19\frac{1}{2}$ minus one-fifth of the age, *e.g.* at thirty to $19\frac{1}{2}$ minus six, or $13\frac{1}{2}$ years. Abuse of narcotics other than alcohol, *e.g.* **opium**,[2] and habits other than over-indulgence in narcotics may also reduce expectation.

3. **Existence** of a morbid or abnormal condition such as—

(1) **Blindness.**—Usually met by an addition of ten years to the age. (2) **Hernia.**—This, unless the individual agrees to wear a truss, renders his life uninsurable. (3) **Loss of Limb** or malformation interfering with the power of locomotion. For loss of a leg three years is usually added to the age, but Sieveking thinks this insufficient. (4) **Open Ulcers.**—These must be healed before the life can be accepted. (5) **Deafness.**—No addition is usually made for this, although, like blindness, it undoubtedly exposed the individual to increased risk of accident. (6) Loss of **teeth.**—(7) Presence of **disease.**

Finally, it should be remembered that in the same case there may exist a combination of influences reducing expectation. The locality of residence, occupation, or habits of an individual may, for example, have the effect of augmenting the damage caused to his expectation of life by disease or a tendency thereto. Thus residence in a tropical climate may augment the damage to expectation resulting from certain diseases of the digestive organs. An occupation involving much exertion may augment the damage due to certain affections of the circulatory system; or one involving much anxiety of mind, the damage due to a tendency to brain disease. Intemperate habits again increase the damage due to disease generally, and especially the damage resulting from affections of the nervous and digestive organs. For the detailed examination for these defects see below.

[1] C. Muirhead, causes of death amongst Scottish Widows Fund, A. D. Secy, 1892.

[2] *Op. cit.*, pp. 97, 143.

Examination of Applicant.

HOW THE EXISTENCE OF INFLUENCE TENDING TO SHORTEN LIFE IS ASCERTAINED.

The usual method is as follows: The individual proposing to assure is—(1) Supplied by the insurance company with a series of printed questions, to which written answers are required. (2) Required to refer to two or more persons personally acquainted with him (one being his usual medical attendant), and to these *referees* of the proposed assuree a similar series of questions are addressed. (3) Examined by a medical man acting on behalf of the company, who also is usually supplied with a series of questions to be put to the proposed assuree—in the scheme of life insurance without examination the applicant is made to pay much higher rates for the extra risks;—and (4) required to sign a formal declaration to the effect that his statements are true, and are to be taken as forming the basis of his contract with the assurance company.

Printed questions.—The object of the questions put to the proposed assuree is, of course, to ascertain whether or not he is subject to any hereditary or other influence tending to shorten life, and being put in a categorical and formal way, delicate questions, such as to previous syphilis, can be asked as a matter of course. In answering them and generally the assuree is bound to exercise the utmost good faith in the representations he makes to the assurers; failure in this respect on his part will, as a general rule, render the policy void. Further, save in very exceptional cases, misrepresentation or concealment of material facts will render the policy void. Hence arises a fourth question in regard to life assurance, which presently must be considered, namely: Has there been misrepresentation or concealment of material facts?

Referees.—Any person the assuree nominates as one of his 'referees' may refuse to act in such capacity; but if he undertakes the duty, he is bound, like the assuree, to exercise the utmost good faith in discharging it, at the risk, should he fail in doing so, of rendering himself liable to an action should loss ensue. Hence 'the usual medical attendant' of the proposed assuree, if he accepts the duty of a referee, is bound to answer truly all questions put to him, and to disclose every material fact known to him; or, should he have no knowledge as to any particular fact, in regard to which information is required from him, to state so distinctly.

Medical examination.—The examination of the proposed assuree should be thorough, and, in order that nothing may be omitted, should be conducted in regular order, somewhat as follows :

MEDICAL EXAMINATION OF THE PROPOSED ASSUREE.

General external examination.—This may (*a*) directly or (*b*) indirectly disclose the existence of a condition tending to shorten life. The chief conditions coming under head (*a*) are blindness, hernia, loss of a limb, or malformation interfering with the power of locomotion, open ulcers, and deafness.

(1) **Gait, manner, and general appearance.**—This may indicate actual disease of the nerve centres, or of a tendency thereto ; or premature decay, the individual looking older than his age ; or existence of a habit tending to shorten life, *e.g.* intemperance. (2) Skin disease : a disease of this class may indicate a constitutional taint of intemperate habits. (3) Weight : this should be in fair correspondence with the height. From the table on p. 45, it will be seen that roughly a male European, 5 feet 7 inches in height, should weigh about 150 lbs., and 5 lbs. more or less for every inch above or below this height. The proportion borne by the weight to the height appears, in the case of natives of India, to be as a rule lower than among Europeans. Very low or very high weight in proportion to the height, or marked recent gain or loss in weight, should be looked on with suspicion. A variation in weight of more than 20 per cent. from the standard is regarded by most authorities as incompatible with normal health. (4) Vaccination.—The unvaccinated or the unprotected by a previous attack of smallpox are considered unsound, and are not accepted at all by several offices, or, if accepted, death from smallpox and its sequelæ are excluded from the contract, or an extra premium exacted.

In England the percentage of deaths from diseases of the chief systems to total deaths, is about as follows : respiratory, 30 (one-third of these from phthisis) ; nervous, 13 ; circulatory, nearly 7 ; digestive, about 51 ; and genito-urinary, about 2 per cent.

In India a very large proportion of the total deaths (in the Bombay Presidency about 65 per cent.) are attributed to 'fever.' In ordinary years, 'bowel complaints' come next, being credited with (in Bombay) about 8½ per cent. of the total deaths. In exceptional years, the deaths from cholera exceed those from bowel-complaints. Thus, in 1877 (the famine year), in Madras,[1] 22 per cent., and, in Bombay, 9 per cent. of the total deaths were reported as from cholera.

The various systems of the body should next be examined.

[1] The total death-rate in Madras in 1877 was 53·2 per 1000.

Respiratory system.—Respiration should be quiet and easy; its ratio to the pulse 1 to 4 or 5, and not quicker than 20 per minute. The chest should expand in all directions, and there should—especially below the clavicles—be no flattening. Deep inspiration should cause no distress. There should be no lividity of the lips, or tips of the ears or fingers; and the individual ought to be able to count aloud rather slowly 1 to 20 or 30 without taking fresh breath. The circumference of the chest should be in fair correspondence with the height, and in suspicious cases the 'vital capacity' (*i.e.* the volume of air expelled after the deepest possible inspiration by the deepest possible expiration) should be ascertained. The chest should be examined by percussion and auscultation, and special inquiry made as to previous hæmoptysis, cough, loss of weight. A single occurrence of hæmoptysis, Sieveking thinks, should be met by an addition of fifteen years to the age, and the life should be altogether rejected if examination shows decided evidence of the existence of tubercular deposit. Out of 524 deaths from phthisis in the Scottish Widows Assurance Society, Dr. Muirhead found that certainly not more than 35 per cent. exhibited any family predisposition, and this percentage corresponds closely with the 34 per cent. of Dr. Williams and with the 36 per cent. of Dr. Cotton. A family history of phthisis is just as common amongst non-consumptives, and he formulates the statement that "15 per cent. at least of proposers to the Society for assurance, and of those accepted by the Society, will show a record of death by consumption among their parents." [1]

Nervous system.—The principal symptoms indicating existence of actual disease of this system are paralysis, want of co-ordinating power, hyperæsthesia, anæsthesia, and certain affections of the special senses. A tendency to disease of this system, again, may be indicated by repeated attacks of giddiness or headache, or by a general appearance of plethora, accompanied by shortness of the neck. Disease of the spinal cord, a previous attack of apoplexy, or confirmed epilepsy, render the life uninsurable. Previous attacks of other diseases, *e.g.* sunstroke, impair expectation in proportion to the amount of persisting damage. Sexual incapacity in males is an early symptom in many neuroses. Knee-jerk and eye-reflex should always be tested.

Circulatory system.—The **pulse** should be regular between (in adults sitting) 70 to 85 per minute,[2] soft, but not too

[1] C. Muirhead, *op. cit.*, p. 97, etc.

[2] Pulse-rate is often increased by nervousness of candidate during examination.

compressible. Change of posture should not make a difference of more than 10 beats per minute. The **heart sounds** should be normal, and the apex-beat in the fifth intercostal space about 1½ inches below, and the same distance to the right of, the left nipple. If a murmur exists, and there is reason to suppose it to be not due to organic disease, postponement of the assurance should be advised. If due to valvular disease, its intensity affords no indication of the amount of danger. Certain forms of valvular disease damage expectation more than others. Aortic regurgitation is the most serious, from liability to sudden death, whilst aortic stenosis and mitral disease, especially if regurgitant in character, is much less serious. Fatty degeneration of the heart obviously greatly impairs expectation. In the **rheumatic** class prognosis depends largely, or in considerable degree, on good compensation and absence of recurrence of attacks of rheumatism. Age is also important, as acute rheumatism is more a disease of early life—occupation quiet and habits regular. Aortic regurgitation should be rejected, and also double mitral disease. Generally cardiac diseases should be accepted only on careful consideration and in certain selected cases, otherwise a heavy addition should be made in a case of a would-be insurer exhibiting functional disorder of the heart, produced by excessive tea or coffee drinking or tobacco smoking, and especially in regard to tea intoxication. The subsequent cardiac irregularity might be so great, in fact, that any medical examiner must reject the candidate, if afforded only one opportunity of examination. A second examination should be obtained in two or three years' time. **Tea** acts on the acceleration of the heart without clouding the higher cerebral functions, but in very varying degrees in different individuals. The chief symptoms of excessive tea-drinking are found in the heart's action. The cardiac symptoms are (1) increased rapidity; (2) intermittency and irregularity, amounting in extreme cases to delirium cordis; (3) pulse very irregular also, and altered in volume and force; and (4) no pericardial rub, though sounds might be quite arhythmic. These symptoms are due to tea alone, and would disappear in two or three weeks if the tea-drinking were discontinued. The irregularity is of purely nervous origin, it does not end in organic disease of valves, or affect the heart except possibly in the direction of dilation of the cavities. The tea or coffee habit could be easily given up by most persons. In the case of the tobacco habit, the heart becomes irregular and irritable, but the cardiac complications are removable by stoppage in this case also. There are no interstitial depreciations of the heart as in the case of chronic alcoholism; the effects are transient, and

call only for the relinquishing of the habit, and they call for the postponement of the insurance examination.

Digestive system.—Under this head the appearance should be noted of the tongue, lining membrane of the mouth, skin, and conjunctiva. Teeth.—Loss of teeth renders the individual unsound, by leading to dyspepsia and diarrhœa, through want of proper mastication. In such cases the proposer should be made to get and use a set of artificial teeth before he can be considered sound. Pyorrhœa-alveolaris is very common in Indians, and the life should be declined till the pyorrhœa is cured. Inquiry should be made as to the state of the appetite and action of the bowels, and as to present or previous existence of piles, jaundice, hæmatemesis, chronic vomiting, and symptoms of dyspepsia generally. Inquiry should also be made as to previous attacks of malarious disease, and an endeavour made to ascertain the condition of the spleen. Enlargement of the liver (except when due to simple congestion) renders complete rejection of the life advisable. If due to simple congestion, the examination should be postponed until the liver has recovered its normal dimensions.[1]

Genito-urinary system.—Œdema or puffiness, especially of the eye-lids, hands, feet, or scrotum, should be looked for, and inquiry made as to the existence of lumbar pains or dysuria. Inquiry should also be made as to existence or otherwise, in males, of sexual incapacity and urethral stricture; and in females of symptoms indicating ovarian or uterine disease. The urine should always be passed in the presence of the examiner, for substitution of urine is a common trick with diabetes applicants. Its specific gravity should be 1015 to 1025, and it should be free from blood, sugar, and albumen. Persistent presence of any of these renders the life uninsurable. The urine should also be examined for the presence of bile pigments, pus, tube casts, and crystalline deposits.

Colour blindness.—Special examination should be made for this in the case of sailors, railway guards, locomotive engine drivers, or others whose occupations are such as to expose them to danger should they mistake the colour of a signal. The form of the affection may be inability to distinguish red, or green, or violet, constituting, as the case may be, red blindness, green blindness, or violet blindness. Of these three forms the first is most, and the last least, common. Or the inability to distinguish these colours may be incomplete, the most common form. Examination for colour blindness is best conducted by Holmgren's method: the lantern test now preferred. This

[1] Sieveking, *op. cit.*, p. 169.

consists in placing before the individual a number of skeins of wool of various shades of colour, and making him sort them in order according to their colour and shade.

Other Questions.

Other questions which may arise in connection with Life Assurance are:—Has there been misrepresentation or concealment of material facts? Has the death of the assured taken place? Did the assured kill himself? What was the cause of the assured's death?

HAS THERE BEEN MISREPRESENTATION OR CONCEALMENT OF MATERIAL FACTS?

This question arises when liability to pay the sum assured is disputed on the ground that the policy is void, owing to such misrepresentation or concealment.

Identification of the proposer.—If the proposer is previously unknown to the medical examiner he must be introduced by some one who vouches for his identity, and identification-marks should be noted.

Concealment of material facts.—A material fact is anything the assurers have a right to be informed of, which may influence the rate of premium, irrespective of whether the party from whom the information is required does or does not know it may have this influence, and irrespective of whether the fact is or is not a condition of things which has actually shortened the life of the assured.

The question whether a given fact is material or not may be one on which expert evidence is not required, *e.g.* previous rejection of the life by another assurance office. Frequently, however, the fact alleged to be material is the existence at the time of effecting the assurance of a particular habit or disease, or previous attack of disease. Here the question whether the fact is material or not may depend on whether or no such habit or disease is one which usually tends to shorten life, and when this is the case, the opinion of a medical expert may be required in order to enable the Court to decide the question at issue. The existence of disease, or of a previous attack of disease, may or may not be a material fact.—It is a material fact if information regarding its existence has been specifically required by the assurers.[1] For cases of concealment of facts see Appendix.

[1] The questions regarding the present or previous existence of disease, put by assurance offices to an individual proposing to assure his life, after specially mentioning various diseases, usually conclude with the words "or any other disease or disorder tending to shorten life."

On this point it has been decided [1] that when the question is one of material concealment in life assurance, only such diseases come within this description as are of a serious nature, and the usual course of which is to shorten the duration of life. The existence of a habit such as usually tends to shorten the duration of life is obviously a material fact. Commonly there is no difficulty in answering the general question whether or no a particular habit comes within this description. In one important case, however,[2] the expert witnesses called at the trial differed greatly in opinion on the question whether or no opium-eating was a habit tending to shorten life. The same question has arisen in regard to vegetarianism, and it is possible that it might also arise in regard to tobacco smoking. Where, however, the habit is one which, like the two last mentioned, is not usually held to shorten life, the question whether its existence is a material fact or not, has been held to depend on whether or no specific inquiry as to its existence has been made by the assurers. Considerable difficulty is sometimes met with in coming to a conclusion as to whether or no a particular habit existed at the time the assurance was effected. In the case, for example, of alleged intemperate habits, it is difficult to draw a line between moderate use and abuse of alcohol; and often difficult, therefore, to come to a conclusion as to whether what existed at the time of effecting the assurance was the latter or the former. When, however, this is the question at issue, the decision in the case usually rests on the ordinary evidence produced, not on the expert evidence.

To establish that there has been misrepresentation or concealment, the existence at the time of effecting the assurance, of the fact alleged to have been misrepresented or concealed must be proved. This, in many cases, is a matter of ordinary, not expert, evidence. In other cases proof of the existence of the fact concealed rests in whole or in part on expert evidence; *e.g.* the assured may have endeavoured to conceal a previous attack of disease, by concealing the name of his usual medical attendant. Such cases usually present no difficulty. Cases more difficult to deal with are (1) cases where the only evidence available of the existence of a disease tending to shorten life, is evidence of the existence of certain symptoms which may or may not have been due to the disease in question; and (2) cases where the inference that a particular disease tending to shorten

[1] *Watson* v. *Mainwaring;* see Taylor, *Med. Jur.*, II., p. 598.

[2] The suit regarding payment of sums assured on the Earl of Mar's life (1831). The assured was an opium-eater, but this had not been made known to the assurance company (see Christison on *Poisons*, p. 716).

life existed at the time of effecting the assurance, rests on the rapidly fatal termination of the case from such disease. No general rules can be laid down for guidance in cases of this kind. In each case a medical witness must be guided by his knowledge of the symptoms and usual course of the disease alleged to have existed.

HAS THE DEATH OF THE ASSURED REALLY HAPPENED?

This question may in effect be one of identity, namely, Is this body that of the assured? or, in cases where no direct proof of death is obtainable, one of presumption of death. These two subjects have already been considered (see pp. 74, etc.). This question also arises occasionally in cases where, with the view of defrauding an insurance company, an assured disappears, having first fabricated evidence of his own death.

DID THE ASSURED KILL HIMSELF?

Assurance policies almost always contain a clause exempting the company from liability should the assured "die by his own hands" or "commit suicide," or die by the hands of justice. In giving evidence at an inquest, therefore, it should be kept in mind that an opinion as to the cause of death, given at such inquest, may afterwards be called in question in an action to recover assurance money. In such a case, omission to make a thorough examination of the body may place the witness in a very awkward position. Again, a question, which has more than once arisen in the course of actions of this kind, is this: The assured kills himself during an attack of insanity; is this "death by his own hands" or "suicide," as the case may be, according to the phrase used in the policy? On this question the English judges have expressed different opinions. It has, however, been decided by a majority of the judges that these phrases, as used in assurance policies, include all cases of intentional self-killing, no matter whether the individual be or be not insane at the time. Though assurance policies sometimes contain a clause repudiating liability should the assured die by his own hand, in actual practice almost all offices pay unless there has been fraud. Many insert a clause repudiating liability in case of suicide within a short period, usually one or two years.

WHAT WAS THE CAUSE OF THE ASSURED'S DEATH?

Obviously, when it is alleged that the assured killed himself, this question directly arises. So, also, this question may arise indirectly, in a case where it is alleged that there has been material concealment, seeing that the cause of death may afford corroborative evidence of the fact that there was such concealment. Further, the question, What was the cause of the assured's death? may arise in the following cases.

Accident Assurance and other Compensation Claims for Accidental Injuries.

The legal definition of an 'accident' with reference to compensation of claims was established by Lord Macnaghten's ruling in 1903 (*Fenton* v. *Thorley & Co., Ltd.*) as follows: "The expression 'accident' is used in the popular and ordinary sense of the word as denoting an unlooked-for mishap, or an untoward event which is not expected or designed."

Where the life is assured by an insurance policy against accident, the term 'accident' is deliberately restricted by the insurers, and is defined as 'any bodily injury caused by violent, accidental, external, and visible means, and resulting in death or disablement within three months of the accident;' and such restrictions, especially when serious illness or deformity or death follow an accident, although not the probable result of that accident, frequently lead to litigation, though reputable companies usually settle reasonable claims. The following decisions[1] show the extensive range of happenings which have been ruled to come within the meaning of the terms of the insurance policies:—

1856, 1870, 1880.—Drowning, especially when consequent upon an internal disease, *e.g.* epilepsy: *Trew* v. *Railway Pass. Ass. Co.*; *Reynolds* v. *Accidental Ins. Co.*; *Winspear* v. *Accident Ins. Co.*

1859.—Spinal injury from lifting weights: *Martin* v. *Travellers' Ins. Co.*

1864.—Hernia after fall; necessary operation; death: *Fitton* v. *Accidental Death Ins. Co.*

1881.—Falling under railway engine during sudden illness (a fit): *Lawrence* v. *Accidental Ins. Co.*

1887.—Paring corns leads to fatal gangrene of leg: *Durham Spring Ass.*, Cave, J. (*Times*, Jan. 26).

1889.—Shoulder dislocated; while lying up was restless; pneumonia contracted; death within a month: *Isitt.* v. *Railway Passengers' Ass. Co.*

[1] Cited by S. B. Atkinson, M.A., B.A., in *Trans. Med. Leg. Soc.*, II. 13, 1904.

1893.—Cartilage in knee-joint dislocated while stooping: *Hamlyn* v. *Crown Assurance Co.* (Esher, M.R.: "Unexpected result." Lopes, L.J.: "Something unforeseen and unexpected and casual").

1896.—Mental shock, without physical impact: *Pugh* v. *London, Brighton, and S.C. Railway.*

1903.—Scratch on leg; erysipelas in one week; septic pneumonia one week later; death one week later; *Mardorf* v. *Accident Insurance Co.* (Wright, J.: "Not an intervening cause").

On the other hand, the following were held to be *not* 'accidental'[1]:—

1861.—Sunstroke after exposure; death same day: *Sinclair* v. *Maritime Passengers' Assur. Co.*

1870.—Wound in foot; erysipelas in five days; death on seventh day from injury: *Smith* v. *Accident Ins. Co.*

1885.—Fall; dislodgement and impaction of gall-stone; death: *Cawley* v. *National Employers' Accid. Assur. Assocn.*

1889.—Poison swallowed, mistaken for medicine; death (policy excluded such cases): *Cole* v. *Accident Insur. Co.*

1889 (Sc.).—Thrown from carriage; Bright's disease aggravated; death: *McKechnie's Trustees* v. *Scottish Accident Co.*

1892 (Sc.).—Prolapse of hepatic flexure of colon in pulling on stocking; fatal obstruction of bowel: *Clidero* v. *Scottish Accid. Co.*

1896 (Sc.).—Germ infection from undisclosed source: *St. Clair Gray* v. *Northern Accid. Ins. Co.*

1904.—Syncope after ejecting a drunken man: *Scarr* v. *General Accident Assur. Co.* See Prof. Powell's Notes in App. XI.

For non-fatal accidents, the foregoing lists supply useful indications as to the validity of compensation claims, and it has been ruled that even a predisposing infirmity may not vitiate the 'accident;' thus in 1900, hernia recurring in lifting frozen planks was held to be an 'accident' for workmen's compensation (*Timmins* v. *Leeds Forge Co.*). Mental shock, also, has been compensated, as opposed to the more direct nervous shock of an accident.

Case.—**Value of a leg.**—The value of the loss of a leg by an agricultural labourer through being knocked down and run over by a traction engine was assessed at the Reading Assizes by Mr. Justice Lawrence and a Jury at £250.—*Daily News* (Lond.), June 6, 1911.

The insurance company, except by a previous special agreement, has no power to demand a necropsy upon the body of the assured (*Ballantine* v. *Employers Ass. Co.*, 1893), nor can it claim to be represented at a personal medical examination, nor during a necessary surgical operation (Home Office direction in III. *Law Times*, 296). The insurance companies often take a liberal view of the circumstances, thus in the case of a man murdered by a burglar, his death was treated as accidental.

[1] S. B. Atkinson, *loc. cit.*, p. 403.

In fatal cases the question takes the form: Was death due to accident or to natural causes?—the assurers being liable in the former case, but not in the latter. When the cause of death has been definitely ascertained, there is usually no difficulty in coming to a conclusion on this point; and as may be seen from the above list death from sunstroke does not come within the meaning of death from accident, as used in such policies. So, also, there is usually no difficulty when death occurs within a short time after the alleged accident. Where, however, a considerable interval of time has elapsed between the accident and death, difficulty may be experienced in coming to a decision on the question. In such a case points for consideration are: (1) Were the symptoms and *post mortem* appearances present in the case, such as indicate the presence of disease? (2) Could such disease have arisen from the accident? (3) What influence would the accident be likely to exert on such disease? &c., &c.

CHAPTER XXI.

MEDICAL RESPONSIBILITY, PATIENTS' SECRETS, AND MALPRAXIS.

> "*All physicians and surgeons acting unskilfully in their several professions must pay for injury to brute animals the lowest, but for injury to human creatures the middle amercement* (500 *panas*)."—MANU, transl. by Jones, IX. 284.

Obligation of secrecy.—The ethical law of professional secrecy and honour continues to be much the same to-day as it was in the fifth century B.C., in the time of Hippocrates, the 'Father of Medicine,' whose famous 'Oath'[1] was the parent of the 'declaration' which is still incumbent upon medical graduates of our universities, and upon licentiates and diplomates of most of the colleges.[2] The legal obligations, however, and the

[1] The "*Oath of Hippocrates*" runs thus:—"I swear by Apollo the Physician, by Asklepios, by his daughters Hygeia and Panacea, and by all the gods and goddesses, that, to the best of my ability and judgment I will faithfully keep this oath and obligation.

"The master that has instructed me I will esteem as my parents, and shall supply to him, as occasion may require, the comforts and necessaries of life. His children I will regard as my own brothers, and if they desire to learn I will instruct them in the same art without any reward. My patients shall be treated by me to the best of my power and judgment in the best manner, without injury or violence. Neither will I be prevailed upon by any one to administer noxious medicines, nor will I be the author of such advice myself. I shall never recommend means to procure abortion, but will live and practise chastely and religiously. I will not meddle with lithotomy, leaving that to operators of that art. Whatever house I am called upon to attend, I will aim at making the patients' good my chief aim, avoiding all injury, corruption and unchastity; *and whatever I hear in the course of my practice relating to the affairs of life of my patients that ought to remain secret, nobody shall ever know of me.* May I be prosperous, honoured and esteemed by all men as I observe this solemn oath, and may the reverse be my lot if I violate it and forswear myself."

[2] Each medical graduate in the Scottish Universities must take this declaration: "I do solemnly and sincerely declare that as a graduate in medicine in the University of ———, I will keep silence as to anything I have seen or heard while visiting the sick which it would be improper to divulge."

modern craving for publicity, which, among other things, obtains the issue of bulletins signed by the medical attendants, with details of the illnesses of persons of position, have caused the old ethical code to undergo considerable alterations. As a result, the medical man in daily practice has to publicly give away the secrets with which he has been entrusted, or suffer a legal penalty for not doing so. Thus when subpœnaed, and when giving evidence on oath, nothing can be concealed, unless self-incriminating, of which he has knowledge through his attendance on his patients. Insurance companies also require from him the fullest details of the family medical history of patients desiring to be insured, and to divulge matters which might be detrimental to his patient's chance of insurance. The State also obliges him in certain cases of infectious disease and sudden death to notify forthwith to a local authority, comprised of laymen, his opinion that such diseases are in existence, and were he to attempt to conceal such facts, he would incur a penalty, and be treated as a misdemeanant, notwithstanding that such notification might be detrimental to his patients. He is compelled to give to the registrar certificates of deaths of his patients, and such documents are not treated by the authorities as confidential, but copies can be obtained by any one from the registrar on paying a small sum.[1]

Nevertheless, it has been ruled that "secrecy is an essential condition of the contract between a medical man and his employers, and breach of secrecy affords a relevant ground for an action of damages (*A.B.* v. *C.D.*, 14 Dunlop, 2nd S., 177). It is therefore well always to adhere to the rule of inviolate secrecy as far as possible, and never to reveal anything, even the most trivial matters, without the patient's express consent; and so afford no ground for an action for damages for libel or otherwise. Where, however, the divulging of the secret is necessary to protect an innocent person from grave injury in a private or civil case, the conditions are different. On the other hand, the ruling of Lord Mansfield (see p. 16) has been set aside by so experienced a criminal judge as Sir Henry Hawkins, who ruled "that he could quite understand a case, especially in a civil cause, where a doctor was quite justified in refusing to divulge questions of professional secrecy" (*Kitson* v. *Playfair—Brit. Med. Jour.*, 1896, 799). Acting on this later ruling, the demand of the Court to divulge a professional secret was successfully resisted by a practitioner, a graduate of a Scottish University who had made the "Scottish" form of declaration (see p. 434).

[1] A. G. Bateman, M.B., *Trans. Med. Leg. Soc.*, II. 50, etc., 1904.

Case.—**Alleged Adultery.**—At Notts Bench of Justices, in 1900, this action was laid by a husband against his wife, who was living apart from him by deed of separation, for nullification of maintenance order on the ground of alleged adultery. The wife defended the action, and her medical attendant, who was subpœnaed to give evidence regarding the nature and cause of an illness which she had during the period of separation, declined to reveal the character of her illness, and gave several reasons for his refusal. One reason was Sir Henry Hawkins' above-cited statement, and another was that no high legal decision had hitherto been given as to the power of magistrates to compel answers to questions of professional secrecy in a *civil* court. The Bench, after deliberation, decided not to order the practitioner to answer, on the ground that, in their view, he had offered a just excuse for refusing, and they added that, as the incident was novel and interesting, they would be pleased to facilitate appeal to a higher court, which offer was not accepted.—*Trans. Med. Leg. Soc.*, II. p. 66.

Even when the police surgeon or civil surgeon has to *examine a prisoner* for evidence of the crime on his or her person, he should first warn the prisoner that anything found would have to be reported by him whether in favour or against, and that he or she was *legally entitled to refuse permission to be examined.* In the examination of women the surgeon must be especially careful, as already quoted at p. 305. An assault has sometimes been alleged against the surgeon for his examining, at the instance of the police or others, a female alleged to be pregnant or the victim of rape. In such cases the consent of the party must invariably be first obtained by the surgeon in the presence of witnesses, whose names should be duly recorded in noting this fact in the report, and the examination itself should be made in presence of these witnesses. Moreover, the surgeon should not himself undress the female (see p. 305).

If a medical man unnecessarily strip a female patient naked under the plea that he cannot otherwise judge of her illness, it is an assault if he himself takes off her clothes (*R.* v. *Rosinski*, 1 Mood, C. C. 12).

In the case of a child, the **obligation to notify certain infectious diseases and sudden deaths** under suspicious circumstances, is an important part of a practitioner's responsibility. In cases of **attempted suicide,** which is in law only a 'common misdemeanour' (p. 105), if called, he would, of course, attend to the patient as long as he remains under his care, but no legal obligation rests upon the practitioner to report to the authorities, as the attempt to commit suicide is by statute declared to be a misdemeanour, and not a felony. If, however, the patient dies, he should acquaint the coroner, or request the friends to do so. In regard to the crime of attempted **abortion** it seems generally agreed that it is inexpedient for a medical man to go out of his way to give information to the police that a patient of his to whom he was

called had been trying to procure her own abortion; but it is quite different when he ascertains that she has had the aid of a professional abortionist. But in all cases in telling such secrets as compelled by law to do, he should be careful to tell only the proper authority, and mark all letters containing such information 'private and confidential.'

Obligation of skill.—Malpraxis is the want of reasonable skill and care on the part of the medical attendant, whereby the person under treatment sustains damage to health or life or limb. The 'skill' demanded by the law is not of a high or specially expert kind; but such ordinary skill as is reasonably expected from an ordinary duly qualified practitioner doing his best. Thus a practitioner who prescribed morphine for asthma, whereby his patient acquired the morphine habit, was said to have exercised 'reasonable' skill. Another practitioner who kept a Colles' fracture in a splint for several weeks, whereby adhesions of the extensor tendons occurred, was also said to have exercised 'reasonable' skill.

Case.—**Ordinary not eminent skill to be expected** (*Gibbs* v. *Tunaley*). —It was ruled that the jury were not to expect the same amount of eminent skill in a country practitioner as is to be met with in large towns; but they had a right to expect from him the usual and ordinary amount of skill, care, and attention which it was only reasonable to suppose he would possess; and if in the discharge of his duty he applied his professional skill and knowledge to the best of his ability, then, however unfortunate the determination of the case, he was not to be held responsible. The case was one for damages, but this ruling would probably apply to the treatment of a wound; and if death followed, even if the treatment could be shown to be not as good as might have been obtained elsewhere, the person who caused the wound, and not the medical man, would be held responsible for the death.—*Norfolk Lent Assizes*, 1846.

In the treatment of a case of criminal wounding the position of the surgeon in charge of the case is one of great responsibility, for if the wounded person dies, the surgeon may be blamed for his treatment. It may be alleged by the defence, on the one hand, that any operation the surgeon may have done contributed to or caused the fatal result, or, on the other hand, that the death would not have occurred if a certain operation had been performed. A similar question may also arise with reference to medical treatment and nursing. What the law requires of a medical man in the treatment of a case is only that he will exhibit 'reasonable skill and care.' An operation in a criminal wound-case, or for producing justifiable abortion (see p. 317), should never be undertaken except with the object of saving life; and before performing it another surgeon should, if possible, be consulted so as to share your responsibility. Where this latter course is not possible, as in isolated country towns, the surgeon

should use his utmost skill, and this is all that the law requires of him.

Deaths under chloroform, or other anæsthetic administered for the purpose of performing an operation, would be judged of in the same way, namely, 'was the anæsthetic necessary,' and 'was it administered with reasonable skill and care?'

In every case where an operation is performed, the consent of the patient, or of his guardian if a minor or unconscious, must first be obtained.

In fractures and dislocations, it is well to use the X-rays to prove that fixation and reduction have been accomplished, or if not, the surgeon should have written proof that he suggested its employment to the patient, and was refused its aid. The skiagraph, however, can never form the basis upon which the amount of damages is assessed. That will depend, as formerly, upon the functional disability and loss which the patient has sustained. Whenever a skiagraph is introduced as evidence, the defendant should demand the privilege of having a similar examination made, and should employ expert testimony to fully explain its meaning to the jury.[1]

The treatment followed should be of the recognized or established kind, and no new form of treatment of the nature of an experiment should be practised without the consent of the patient or guardian.

The 'care' should be of such actively attentive kind as never to give reasonable excuse for a charge of neglect or carelessness. Cases have occurred of syphilis and puerperal fever having been conveyed by a surgeon through carelessness.

Fees for abandoned operation.—A surgeon is entitled to claim his fees for an operation which, having begun, he deems it wiser not to complete.

Case.—The above ruling was made by a King's Bench jury in June 19, 1919, in case of *Mr. Bowring* v. *Mrs. Cook*, wherein a tumour supposed to be a fibroid was found on incision to be a sarcoma, when the operating surgeon decided not to remove the tumour. The fee involved was £42.

Responsibility of hospital authorities to patients.—A patient who has sustained injuries in the course of an operation performed upon him may sue the presiding surgeon for damages and not the hospital authorities; also, it would seem, the medical student, nurse, or other attendant who in obeying the surgeon's directions assisted in inflicting the injuries may be sued.

Case.—**Hillyer** *v.* **St. Bartholomew's Hospital** [1909, 2 K. B. 820].—W. H. Hillyer, a medical man, entered the hospital to be examined under

[1] Dr. Leonard in *Medical News*, February 25, 1901.

an anæsthetic. The examination was conducted by a consulting surgeon of the hospital on an operating table. His left arm came in contact with a hot-water tin projecting underneath the table, burning the upper arm, and the right arm was said to be bruised by some person pressing against it during the operation. The result was traumatic neuritis and paralysis of both arms. The examination was undertaken gratuitously. The hospital authorities were held not to be liable for negligence when the nurses and other servants were acting under the orders of the surgical and medical staff.

Continuance of attendance.—Even in ordinary civil practice it is necessary for the practitioner at times to protect himself against possible charges of neglect made by an unreasonable patient or his friends, when the surgeon has been called in casually to see the case, and has not been definitely asked to continue to attend it. It is well, therefore, in such instances, to take the precaution of getting such people to record definitely in writing whether they desire him to attend the case or not. Once he undertakes to attend the case, he is bound to continue his visits as long and as frequently as the requirements of the case may demand, and he is held to determine when his visits may safely be discontinued, though he is always at liberty to discontinue his attendance at any time by giving reasonable notice of his intention to do so.

PART II.

POISONING OR TOXICOLOGY.

CHAPTER XXII.

POISONS IN THEIR GENERAL ASPECTS.

Poisoning, with its secret treachery, has from early times been especially ascribed to the East as the favourite means employed by assassins to remove objectionable persons and take life; and certainly at the present day poisoning is very much more common in India and the East than in Europe.

Poisons were doubtless early discovered by primitive man, who by experience or accident must soon have learned to avoid them himself and to use them against his enemies or game; for nearly all savage tribes use poisoned arrows. Indeed, the classic term 'Toxicology' is derived from the Greek word for 'an arrow or missile for the bow,' which would indicate that the earlier use of poison in Eastern Europe was to smear over arrows for slaying. The modern word 'poison' comes from the Latin *poto*, to drink, as signifying the more modern mode of administering a poison, namely, as a 'potion' or draught. The Indian term *Bish* is from the Sanskrit root 'to permeate or pervade' and denotes the intruding, alien and diffusive nature of poison. The ancient Indian scriptures contain references to the poisoning of kings, the doings of professional poisoners and of widespread organized poisoning in almost prehistoric times. In one of the *Shastras* translated by Dr. Wise[1] it is written: "It is necessary for the practitioner to have a knowledge of the symptoms of the different poisons and their antidotes, as the enemies of the king, bad women and ungrateful servants, mix poison with food." Susruta, the Indian Hippocrates, describes the several modes of poisoning in ancient India, how the

[1] Medicine of the Hindus.

poisons are mixed with food or drink, honey, medicine, bathing water, anointing oils, perfumes, eyelash pigments, snuff; or sprinkled over clothes, beds, couches, shoes, garlands and jewellery, saddles of horses, etc.; how poisonous draughts are prescribed as love-charms, also the secret poisoning of wells and other drinking-water to destroy enemies.

The Mahābhārat, which is usually ascribed to the 5th or 6th century B.C., mentions that Bhim Sen, the Hindu Samson, was poisoned by his cousin Durjodhan in revenge for being defeated by him in a duel. In a semi-historical legend of mid-India[1] it is related that the grandfather of Asoka, Chandra Gupta, a contemporary of Alexander the Great, sent to the latter monarch in the guise of a present, a fascinating girl who was a 'poison-maiden' fed on poison until she was so saturated with venom that her embrace would prove fatal to an ordinary mortal—the mere conception of the idea of such a Borgia-like siren would imply considerable familiarity with poisoning.

Strabo relates that the custom of burning Hindu widows alive on the death of their husbands (*sati*) was introduced as a check against the prevailing custom of Hindu wives poisoning their husbands, so that the wives would thus have an interest in not being privy to the premature death of their lords.

In Mohammedan times, poisoning was a recognized form of capital punishment, and was unusually rife in harem intrigues and against political foes and prisoners.

Many Indians consider the taking of life by bloodshed a greater crime than poisoning, strangling, etc. Note the use of the word "Khun," literally "blood," as a synonym for "murder." A medical witness may be puzzled by the persistence with which an Indian juryman will cross-examine to know if there was any blood spilled on the clothes, etc. If no blood is shed, in their opinion, the manslaughter does not amount to murder, and the punishment should be less.

For magical and mystic purposes without intent to actually kill a good deal of what may be called 'accidental' poisoning goes on in the country districts, see pp. 29 *et seq.*

This is mostly practised here, as elsewhere, by jealous women or desperate lovers of either sex for the purpose of captivating affection or of infatuating and enthralling the object of desire. But it is also used for baneful purposes to cause disease, death, or some strange aberration; and whether employed by love or by hate it has certainly always been intimately connected with some real knowledge of medicine and has veiled a great deal of downright poisoning.[2]

[1] *Mudra-rakshasa* in Wilson's Hindu Theatre. [2] Chevers, *Med. Jur.*, p. 105.

Definition.—It is not easy to define the term 'poison.' It is not enough to define it as 'any substance which on being absorbed into the body injures health or destroys life.' Because (1) certain substances harmless in small doses are capable of causing death when absorbed into the system in large doses although not usually considered poisons, *e.g.* common salt and sulphate of potash in sufficiently large quantities; (2) the toxins of disease, though capable of causing death, are not considered 'poisons' in the ordinary sense of the word: (3) certain substances may cause injury or death by local action without absorption into the system, *e.g.* corrosive acids and mechanical irritants. The definition, therefore, should include, in addition to 'any substance absorbed into the body,' also, 'any substance which by chemical action on the tissues injures health or destroys life.'

For legal purposes in India, however, the exact definition of a 'poison' is not essential, because the law usually paraphrases in explanatory form its reference to 'poison.' Thus, in the causing of 'hurt' and 'grievous hurt' by poison, *ss.* 324 and 326, *I.P.C.*, state: "Any poison or any corrosive substance," or "any substance which it is deleterious to the human body to inhale, to swallow, or to take into the blood." Hence, for conviction under these sections, it is not necessary to establish that the substance by means of which the hurt or grevious hurt was caused is a poison; it is sufficient if it be proved that it is a substance which comes under the above-stated description. Again, *s.* 299 declares: "Whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death or with the knowledge that he is likely by such act to cause death, commits the offence of homicide." Hence, if A administers a substance to B, with such intent or knowledge, and thereby cause B's death, A may be convicted under this section of the offence of committing culpable homicide, irrespective of whether the substance administered may or may not strictly be called a poison. For it is the *intent* which suffices to constitute a crime, irrespective of the dose or even the nature of the substance. In *s.* 328 is: "Whoever administers to, or causes to be taken by, any person, any poison or any stupefying, intoxicating, or unwholesome drug or other thing, with intent to cause hurt to such person, or with intent to commit, or to facilitate the commission of an offence, or knowing it to be likely that he will thereby cause hurt, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine." Here, again, it will be observed that the addition of the words "any stupefying, intoxicating,

or unwholesome drug or other thing," render the exact definition of the term 'a poison' unnecessary for the purposes of this section. It should, however, be noted that the words "or other thing" must be read "other unwholesome thing." Hence, administering a substance as to whose nature no evidence was given, which was intended to act as a charm, was held to be no offence (*R.* v. *Jotee Ghoraee*, 1 Suth. Cr., 7)."[1] The question of a definition of the exact meaning of 'poisonous substance' might arise in the case of a person charged under *s.* 284 of the *Penal Code* with the offence of "knowingly or negligently" omitting "to take such order with any poisonous substance in his possession as is sufficient to guard against probable danger to human life from such poisonous substance."

Restriction on sale of poisons.—In India, with the exception of Bombay Presidency, there is practically no restriction on the sale of poisons, other than a partial one on white arsenic; and this accounts doubtless in considerable degree for the excessive prevalence of poisoning in India. There was no restriction whatever on the sale of poisons, except in Bombay, notwithstanding the repeated representations by myself and other chemical examiners, up till 1899, when the White Arsenic Act (of 1899) was passed, but regulations as to the possession and sale of the white arsenic are limited to such local areas as local Governments may direct, the result being that arsenic may still be readily obtained in large quantities in an ordinary bannia's shop in most bazaars, with practically no restrictions. On poisons other than arsenic, there is no restriction whatever except in Bombay, which in its Sale of Poisons Act incorporates the provisions of the English Arsenic Act (14 Vict. cap. 13).

The Sale of Poisons Act (Bombay Act VIII. of 1866). The chief provisions of this Act are that certain poisons named in Schedule A of the Act (1) may only be sold by licensed vendors (*s.* 3); (2) (except when dispensed as medicine on the order or prescription of a practitioner of medicine) may only be retailed to persons known to the vendor, or in presence of a witness known to the vendor, and to whom the purchaser is also known; and each sale must be entered with the purchaser's name and address in a book kept for the purpose (*ss.* 13, 14, and 19); and (3) pounded white arsenic (except in special cases) may only be sold mixed with soot, in the proportion of one ounce to each pound of arsenic, or with indigo or Prussian blue in the proportion of half an ounce to each pound of arsenic (*s.* 17). Schedule A of the Act enumerates the poisons it applies

[1] Mayne's *Penal Code*, 282.

to, with their vernacular names, as follows: "1. Vegetable poisons.—Aconite (*botchnag*), cocculus indicus (*kakmari, kakphul*), datura (*datura*), henbane (*khorasanu ajwau*), nux vomica (*kuchila and kajra*), Saint Ignatius' bean (*papita*), and Calabar bean. 2. Mineral poisons.—White arsenic (*phutkya somul, somul*), red arsenic or realgar (*mansil*), yellow arsenic or orpiment (*hurtal*), Scheele's green or arsenite of copper, and Schweinfurth green or aceto-arsenite of copper (*khirwa*), and corrosive sublimate (*ruskapur*)." For Bengal, provision has been made to guard against the ignorant compounding of European drugs by unqualified druggists (Beng. Mun. Act, *s.* 252); but no restriction is placed on the indiscriminate sale of indigenous poisons in the bazaar, which is much the greater evil. What is needed is a Bill for all India somewhat similar to the poison schedule of the English Pharmacy Act (31 & 32 Vict. 21), as is in force in the Bombay Presidency. In Government dispensaries the rules for the custody and dispensing of poisonous drugs prescribe that the labels of poisons be printed on yellow paper with the word 'poison' in English and vernacular affixed to all bottles, and that a copy of the rules, pasted on paper or board, is to be suspended in every apartment where poisons are dispensed.

The need for legal restrictions, even in the large cities, is shown by the following recent case.

Case.—**Accidental poisoning through carelessness.**—In 1901, a Mr. Hicks, at Calcutta, was taken ill with dysentery, and was advised to take a vegetable compound known as '*Supari-ka-phul.*' This drug was obtained from the grocery of Ram Nath Dass, but with it was a large quantity of aconite, which is a deadly poison. This was administered unwittingly to Mr. Hicks, who succumbed to the effects. It was impossible to tell from the contents of the stomach what quantity of aconite was actually administered; anyhow, the accused was ordered to be prosecuted on a charge of doing a rash act by omitting to take due care in the sale of a poisonous drug. The accused raised the plea that the sale was actually effected by his assistant, and that he was not responsible for the acts of his servant. The Court held a contrary view; moreover, the accused was found guilty of gross neglect by not exercising due and proper control of the aconite. The accused was convicted under *s.* 268, *I. P. C.*, and sentenced to three months' rigorous imprisonment.

It is not yet possible to get any precise estimate of the prevalence of poisoning in India as a whole, for no systematic attempt is made to record this information in official statistics. An estimate is only to be formed approximately by piecing together the figures in the various provincial police and sanitary returns with those of the chemical examiners. The police returns only refer to reported cases of criminal poisoning, and the sanitary only to reported fatal cases; and the chemical

examiners' return is simply the record of the results of analyses in the small proportion of cases in which viscera and vomit and other suspected matters are sent for analysis.

For Bengal, the statistics, such as they are, have been collated by Drs. J. F. Evans and C. L. Bose,[1] for comparative purposes, for the two quinquennial periods 1876 to 1880, and 1889 to 1893, with the following results: Murder by poison.—During the five years 1876 to 1880, 94 cases of murder by poison in Bengal were reported by the police, and during the five years 1889 to 1893, 81 cases, or an average of 0·31 and 0·23 per million of the population respectively, as compared with an average of 12 cases in England, 0·07 per million of the population for the years 1876 to 1880, which shows that in Bengal murder by poison is more than four, and over three times respectively the rate for England. In these cases the evidence of murder was usually, if not in all, established by the chemical analysis.

Suicide by poison.—During the five years 1876 to 1880, 11,662 suicides, or 38·8 per million of the population, were reported by the Sanitary Commissioner for Bengal, and during 1889 to 1893, 15,743 or 45·8 per million. As the number of suicides in all England and Wales in the year gives 65·2 per million, the reported suicides in India are less relatively; but there is every reason to believe that a large number are never reported. No returns for Bengal, however, show what proportion of these suicides is due to poisoning. For Calcutta city, however, the statistics are more complete, and these give for the years 1876–80, 126 cases, and for the years 1889–93, 236 cases, or an average of 36·42 and 68·84 per million respectively (registration is more accurate of late years) as against an average of only 3·55 per million in England for the years 1876–80. And of the total cases of suicide in Calcutta 55·8 per cent. were due to poison, as against 12·25 in England, showing that suicide by poison is about nineteen times more prevalent in Calcutta than amongst the general population of England. The conditions of life in a city are likely to make suicide more prevalent than in rural areas. Accidental fatal poisoning.—There are no statistics available for the province, but for the town of Calcutta there were respectively 14 and 11 such deaths reported during these two periods, or a rate of 6·5, and 3·6 per million, excluding snake-bite, as compared with 5·15 per million per annum for England during 1876–80. A very large number of such deaths are believed to pass unreported, especially in the practice of ignorant quack native medical

[1] *Trans. Ind. Medl. Congress*, 1894.

practitioners. Non-fatal cases of poisoning.—There are no provincial statistics for these, except for the reported criminal cases by the police. These are mostly cases in which *datura* or other stupefying drugs are given for the purposes of theft. There were 161 such cases in 1889–93 reported, or 0·46 per million of the population. The Calcutta hospitals in 1898 treated 127 non-fatal cases.

The special poisons usually selected for homicide and suicide in India are very few in number, consisting chiefly of arsenic, opium and a few indigenous substances (alkaloids and European poisons are only used in a few cases in cities); and each poison has, by long-established custom, come to be used for a particular class of crime. Thus :—

For homicide	Arsenic is chiefly used in about half of the cases. Aconite comes next. Nux vomica. Mercury, copper, antimony. (Opium for murder of children and drunken persons.)
For suicide	Opium chiefly—about three-fifths of total cases in Bengal. Arsenic about one-fifth of the cases.
For stupefying for robbery of fatuity (not necessarily with intent to murder)	*Datura.* Indian hemp.
For abortion	*Plumbago rosea.* Oleander. *Calotropis sp.* Colocynth.
Accidental	Snake poison, aconite, mercury, arsenic in quack medicines.

The relative frequency with which particular poisons are used in fatal cases may, to some extent, be estimated from the reports of the chemical examiners on the results of their analysis of human viscera in poisoning cases. The two poisons most frequently used in India to take human life are arsenic and opium. Arsenic is especially used for homicide (and also cattle poison), whilst opium is the special favourite for suicide; occasionally it is used for homicide, in case of young children or drunken persons. The next most frequent poison is datura, used for stupefying people to facilitate robbery. Others less frequently used are :—

Mineral.—(*a*) Copper.—Cases of poisoning by compounds of this metal sometimes arise accidentally from contamination of food by the copper cooking vessels largely employed in India; occasionally, however, cases of attempt at homicide by the

administration of sulphate of copper are met with. (*b*) Lead.—Chronic poisoning by lead, common in England, is rare in India. Red lead, however, is tolerably frequently met with in India as an ingredient of local applications employed to procure abortion. (*c*) Mercury.—Cases of chronic mercurial poisoning arising from malpraxis, although not met with so often now as formerly, are still occasionally seen. Occasionally also ruskapoor, or calomel containing a variable percentage of corrosive sublimate, is criminally employed. (*d*) Pounded glass.—This is popularly believed in India to be a powerful poison, and is occasionally mixed with food with homicidal intent.

Vegetable.—Next to opium and datura, the vegetable poisons most frequently used for homicidal and suicidal purposes are aconite, oleander (or nerium odorum and cerbera thevetia), nux vomica (and its alkaloid strychnia), and various euphorbias. Of these, aconite and strychnia have also given rise occasionally to accidental cases, notably, the first, from its use as a fortifying agent for alcoholic liquor, and the second, from its use as a dog-poison. The seeds of cerbera thevetia are sometimes used as a cattle-poison, and the milky juice of the milk bush, and other euphorbias, as an ingredient in irritant preparations employed as local applications, plumbago rosea, and occasionally various cucurbitaceous tubers, are internally administered for the purpose of procuring abortion. Madar (*calotropis procera*) and tobacco are said to be used for purposes of infanticide, and in some parts of India a paste made from the seeds of *abrus precatorius* is used, by subcutaneous insertion, for the purpose of destroying cattle.

Classification of Poisons.

Poisons may be classified according to their action, as on the opposite page.

1. **Irritant poisons,** or such as possess a marked local irritant action, exciting irritation and inflammation; and when swallowed cause vomiting, and, as a rule, also purging. A few of these, when concentrated, act as 'corrosives,' *i.e.* cause chemical destruction of the tissues. Foreign bodies, *i.e.* powdered glass, stones of fruits, etc., act in this way.

2. **Neurotic** are poisons such as have a specified action on the nervous system, brain or spinal cord. (1) Cerebral poisons, or such as act mainly on the brain, causing delirium or narcotism; and tending to death by coma. (2) Spinal poisons, or such as act chiefly on the spinal system, causing either tetanic spasm, or local anæsthesia or hyperæsthesia, or paralysis;

- **Irritants** (chiefly topical)
  - Mineral
    - *Mineral Acids.*—Sulphuric, nitric, hydrochloric, fluoric (carbolic). — Corrosives. — Topical.
    - *Alkalies and Carbonates.*—Potash, soda, and ammonia. — Corrosives. — Topical.
    - *Alkaline Salts.*—Nitrate and sulphate of potash, barium, etc. — Irritants. — Topical.
    - *Metallic.*—Arsenic, antimony, mercury, lead, copper, zinc, iron, chrome tin, silver, bismuth. — Irritants. — Topical.
    - *Non-metallic*—Phosphorus, bromine, iodine, chlorine (aniline) and glass. — Irritants. — Topical.
    - *Organic Acids.*—Oxalic, acetic, etc. — Irritants. — Topical.
  - Vegetable
    - *Purgative.*—Colocynth, madar, aloes, croton, gamboge, hellebore, arum, etc.
    - *Abortive.*—Ergot, savin, plumbago.
    - *Nervine.*—Laburnum, yew, oxalic acid. — *Nervine.*
    - *Hæmolytic.*—Abrus, ricinin, saponin. — *On blood.*
  - Animal
    - Venomous snakes. — *On blood.*
    - Cantharides and arthropod poisons, *e.g.* centipedes, scorpions, wasps.
    - Putrid food and fish—ptomaines.
    - Trichiniasis and tapeworm.
    - (Auto-intoxications.)
- **Neurotics** (chiefly vegetable)
  - *Cerebral*
    - Opium and morphine. — *Narcotic.* — *On brain.*
    - Chloroform, chloral, cocaine. — *Anæsthetics.* — *On brain.*
    - Alcohol, ether, phenacetin, sulphonal, carbolic acid, creasote, fusel oil, naphtha, benzol, petroleum, nitrobenzol, nitroglycerine, aniline, camphor, and turpentine. — *Inebriants.* — *On brain.*
    - Belladonna, datura, hyoscyamus, Indian hemp, cocculus, indicus, lathyrus, poisonous fungi. — *Deliriants.* — *On brain.*
  - *Spinal*
    - Strychnine and nux vomica, brucia gelsemium. — *On cord.*
  - *Cerebro-spinal, cardiac, etc.*
    - *Depressants*
      - Tobacco digitalis, oleander, aconite, colchicum, hydrocyanic acid. — *On heart.*
    - *Asphyxiants*
      - Carbonic acid, carbonic oxide, coal gas, nitrous oxide, sulphuretted and carburetted hydrogen, sewer gases. — *On lungs.*
    - *Peripheral*
      - Conium, curara, etc. — *Nerve-endings.*

and tend, as a rule, to cause death by asphyxia, from spasm or paralysis of the respiratory muscles. (3) Cerebro-spinal acting of both systems. (4) Cardiac poisons, or such as act mainly on the heart and tend to cause death by syncope.

Many poisons possess more than one of the above described actions, and may therefore be classed in more than one of the above groups. Thus, some poisons possess both a marked local irritant action, and a specified remote action on the nervous system, and may be called 'neuro-irritants,' and such of these irritants that act on the brain may be called 'narcotico-irritants,' *e.g.* aconite. Some neurotic poisons, again, have a marked action on both the brain and spinal system, or on both the brain and the heart, and hence arise the terms cerebro-spinal and **cerebro-cardiac** poisons.

Action of Poisons.

A poison may produce its effects by being administered by the mouth, into the lungs, absorbed through the skin, injected into a wound, or introduced into the rectum, or vagina, or ear. A good many cases of fatal poisoning nowadays occur from intravenous administration of salvarsan, antimony tartrate, etc., and many from intrathecal injection of stovain, novocain, etc., in spinal anæsthesia.

The action of a poison may be (1) local, or (2) remote, and the same poison may possess both a local and a remote action.

Local action of a poison results from its direct application to the part and may consist in the production of (*a*) Corrosion, *i.e.* chemical destruction, as in the case of the strong mineral acids; (*b*) Irritation and inflammation, as in the case of cantharides, tartar emetic, etc.; or (*c*) Certain nervous impressions, as in the case of opium, aconite, cocaine, etc.

Remote action of a poison may be of a non-specific or specific character. Non-specific.—Poisons which possess a remote non-specific action on the system, producing thereby an effect similar to that which often results from severe mechanical injury. Extensive corrosion produced by a corrosive acid may, for example, be followed by shock, as a remote non-specific action. Specific.—This may consist in the production of tetanic spasm, as in poisoning by strychnine; syncope, as in poisoning by tobacco; nephritis, as in poisoning by cantharides; gastritis, as in poisoning by arsenic, etc., etc. The remote specific action of a poison results from the absorption of the poison into the system through the blood. Absorption takes place with extreme rapidity. Blake, from his experiments, inferred that a poison might be diffused through the whole body in nine seconds;

and Erichsen, in a case of extroversion of the bladder, found potassium ferrocyanide in the urine one minute after it had been given by the mouth on an empty stomach. As poisons are absorbed into the system through the blood, it indicates the advisability, in the case of poisoned wounds, of applying a ligature above the wounded part, and endeavouring to remove the poison from the wound by excision and suction. Again, it indicates that after death, absorbed poisons will probably be found, in greatest quantity, in organs containing much blood, *e.g.* the liver.

In some cases the remote action may be the result of 'sympathy,' that is, of impression conveyed to the nerve-centres by the nerves, as where hydrocyanic acid kills in two seconds.

Causes modifying the action of a poison. These are:—

1. **Quantity.**—The administration of a large dose of some poisons is sometimes followed by symptoms differing greatly in character from those which follow a moderate dose; *e.g.* moderate doses of arsenic produce irritant symptoms, very large doses sometimes cause death by shock without irritant symptoms (see *Case* (3), p. 486).

2. **Form.**—(1) Physical. Poisons act most rapidly when gaseous; next, when liquid; next, if in fine powder; and least rapidly when in solid masses (see p. 489). (2) Chemical. This may render an active poison inert, *e.g.* corrosive acids may be rendered inert by combination with alkalies; or (*b*) it may render the poison more soluble, increase the rapidity with which it acts, or, by rendering it less soluble, diminish the rapidity of its action.

3. **Mechanical mixture** with inert substances, *e.g.* dilution or mixture with inert powders, in some cases may **alter** the character of the symptoms; for example, corrosive acids, when diluted, act as irritants only. In other cases, mechanical mixture with an inert substance, by protecting the poison from absorption, may **delay** its action; hence poisons, as a rule, act less rapidly when given on a full stomach. Again, animal charcoal, by taking up a poisonous alkaloid and rendering it insoluble by adhesion, may delay or **prevent** its action.

4. **Mode of application.**—This, by affecting rapidity of absorption, affects the rapidity of action of poisons. Modes of introduction enumerated in order of rapidity of action, the most rapid first, are (1) injection into a vein; (2) application to a wound; (3) application to a serous surface; (4) application to the broncho-tracheal mucous membrane; (5) introduction into

the stomach; (6) injection into the rectum, and (7) application to the unbroken skin.

5. **Condition of body.**—(1) Habit.—This, in the case of many poisons, *e.g.* opium, alcohol, and tobacco, tends to confer on the system a resisting power to the action of the poison to the use of which the individual is habituated. (2) Idiosyncrasy.—This may show itself either in abnormal sensitiveness (or the reverse) to the action of a particular poison—*e.g.* mercury; or the individual may be exceptionally effected by a drug, *e.g.* purged by opium, or by an article of food (see *fish-poisoning*). (3) Disease.—This, if the symptoms of the disease resemble those produced by the poison, tends to confer increased sensitiveness to the action of the poison: *e.g.* narcotics in advanced renal disease. If, on the other hand, the symptoms of the disease are opposed in character to those produced by the poison, diminished sensitiveness to the action of the poison may be the result: *e.g.* narcotics in tetanus. (4) Sleep and intoxication.—These may delay the action of a poison (see *Cases*, p. 486). (5) Accumulation.—Small doses of a poison, each insufficient to cause any serious effect, if given one after the other at short intervals, may accumulate in the system and produce serious effects. Accumulation obviously tends to occur when the rate of elimination of the poison is slower than the rate of its administration. Hence poisons which are only slowly eliminated from the body—*e.g.* lead and mercury, and metallic poisons generally—are specially prone to act as cumulative poisons. Organic poisons are, as a rule, quickly eliminated. In some, however—*e.g.* strychnine—the rate of elimination is comparatively slow, and accumulation tends to occur.

Treatment of Poisoning.

As immediate treatment is so essential, it is advisable to keep an emergency case in readiness for cases of poisoning.

The indications of treatment in cases of poisoning are:—(1) Elimination; (2) Prevention of action; and (3) Counteraction and removal of effects.

1. **Elimination.**—The measures to be adopted for the purpose of procuring elimination of a poison vary with the mode in which the poison has been administered. Thus, if the poison has been injected into a wound, excision of the wounded part and suction are indicated. If the poison has been inhaled into the lungs, the patient must be made to inhale pure air, so that the poison may thereby be chased out of the lungs. If the poison has been taken into the stomach, (1) the

stomach-pump should be used, except in cases of corrosive poisoning, care being taken to inject warm water before proceeding to exhaust, and always remove a little less than the quantity injected; the stomach-pump (or soft rubber catheter in young children) should always be used without delay in serious cases; (2) where the stomach-pump is not available, and in milder cases, and especially in children, promote vomiting by the administration of warm water, or set up by tickling the fauces, or much better by the administration of emetics; *e.g.* mustard and water (one tablespoonful of mustard to half a pint of water for an adult—this has no depressant action at the time or after), or 20 to 30 grain doses of sulphate of zinc, or powdered ipecacuanha, or subcutaneous injection of one-tenth to one-fifth of a grain of apomorphine. Or special treatment may be necessary for the elimination of absorbed poisons, *e.g.* the administration of potassium iodide, in cases of poisoning by lead.

2. **Prevent action or absorption.**—The nature of the measures by which this is carried out varies with the poison, thus:—(1) when the poison is not corrosive or mechanical in action, prevent absorption (*a*) by the administration of substances to render the poison insoluble by **antidotes** (see list in *Appendix*), *e.g.* albumen in cases of poisoning by corrosive sublimate; freshly prepared hydrated ferric oxide in cases of poisoning by arsenic; sulphates in cases of poisoning by lead, etc., etc.; or destroy the poison, *e.g.* cauterize poisoned wounds; or (*b*) by mechanical means, *e.g.* apply a ligature above the wounded part, in cases of poisoned wounds. (2) In corrosion or destruction of the tissues administer antidotes to prevent the action of the poison, by entering into chemical combination with it; *e.g.* the administration of alkalies in cases of poisoning by the corrosive acids. (3) Where acting mechanically only, it is in some cases possible to prevent its action, by the administration of matters which will mechanically protect the tissues from the action of the substance swallowed: *e.g.* the administration of bulky food, in cases where pounded glass has been taken.

3. **Counteract and remove effects.**—In some cases of poisoning this may be done by administering physiological antidotes or substances which exert an action on the system opposed to that of the poison; *e.g.* atropine in poisoning by opium (see list of antidotes in *Appendix*). In other cases this indication is carried out by various measures calculated to counteract or remove the effects of the poison; *e.g.* the use of cold affusion and galvanism in narcotic poisoning; of warmth

to the surface, stimulants, and the recumbent posture in cardiac poisoning; of artificial respiration in cases where the poison taken is one which, like opium and conium, tends to cause death by paralysing the respiratory movements (Schæfer's or other system [p. 236] should be kept up for several hours); of demulcents in irritant poisoning, etc., etc. Special measures for eliminating the absorbed poison, already referred to under 'Elimination,' may also be included under the head of measures directed to the removal of the effects of the poison.

Evidence of Poisoning.

The evidence pointing to the administration of poison may be derived from: (1) The symptoms; (2) The *post mortem* appearances; (3) Chemical analysis; and (4) Experiments on animals.

1. The Symptoms may be General or Special.

General.—1. Sudden onset.—This character, however, may be absent in a case of poisoning, *e.g.* in chronic poisoning by lead, mercury, phosphorus, etc.; and may be present in cases not due to poisoning, *e.g.* apoplexy, cholera, etc. 2. Increase in severity.—This character, like the last, is often present in disease. Again in some cases of poisoning, this character is absent, *e.g.* in the remittent form of opium poisoning (see *Case* below); and in cases where small doses of a poison are administered at short intervals.

Case.—**Remittent opium poisoning.**—"This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit for half an hour, and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of laudanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours, the patient revived, her face became natural, the pulse steady, the power of swallowing returned, she was able to recognize her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes; the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."—Taylor, *Poisons*, p. 552, case of the Hon. Mrs. Anson.

3. Uniformity, *i.e.* with the known effects of a particular poison; hence gastritis followed by salivation, as in acute mercurial poisoning, or by paralysis, as in arsenical poisoning, do not form exceptions to this rule. 4. Begin soon after taking food, drink, or medicine.—This character may be absent owing to the symptoms of poisoning being delayed in their appearance

by sleep, or by intoxication (see *Cases a, b* and *d*, p. 489); or by the counter-active effects of another poison simultaneously administered. Or again this character may be absent, owing to the nature of the poison swallowed; for example, sparingly soluble lead salts only give rise to acute symptoms after an interval of several hours, and a similar interval is often noticed in cases of fish poisoning. This character also may be present in cases not due to poison, *e.g.* cholera, apoplexy, etc., may come on soon after a meal, or rupture of the stomach may occur; and symptoms closely resembling those of poisoning have appeared from swallowing, after exertion, a quantity of cold fluid (see two following cases).

Case.—**Sudden death from swallowing, while heated, a quantity of cold fluid.**—"A young man having just sat down panting, and bathed in sweat, after a severe match of tennis, drank greedily from a pitcher of water fresh drawn from a neighbouring pump. Suddenly, he laid his hand on his stomach, bent forward, became pale, breathed laboriously, and in a few minutes expired."—Christison, *Poisons*, p. 120.

Case.—**Another.**—Death on the fifth day.—A soldier, after a hurried journey on a hot day, swallowed a quantity of iced beer. Six hours afterwards, shivering set in, followed by vomiting, anxiety, thirst, and frequency of the pulse. This was followed by great prostration, hiccough, and lividity of face. Death took place on the fifth day. On *post mortem* examination, the mucous membrane of the stomach was found much reddened, and spots of extravasation were present. The stomach contained blackish matter, similar to what had been vomited during life.—*Ib.* p. 121.

5. Other individuals are affected who partook of the same food, etc. This is a very striking character; it may, however, be present in disease, *e.g.* where, as sometimes happens, several persons after partaking of a meal together are nearly simultaneously attacked by cholera. This character may be apparently absent in a case of poisoning, *e.g.* where (as in *Case* below), of several persons present at a meal, only one partakes of a particular dish. Poisoning also may be indicated by the fact that several persons have suffered from suspicious symptoms, after partaking of articles of food, etc., which have passed through the hands of one and the same individual; although the attacks occurred at different places, and at different times (see *Case*, p. 455).

Case.—**One only of a number killed** by poison.—In a case which occurred in Poona, a man was reported to have died six or seven hours after partaking of food at a feast with about one hundred and twenty-five other persons. No complaint was made by his relations, and the body was buried. Some days afterwards, an anonymous writing was found outside the Magistrate's Court, stating that deceased had been poisoned, and an inquiry was ordered. It then turned out that deceased being of a different caste to the other persons present at the feast, was served

with food separately from the rest by a separate person, and that before death he suffered from symptoms of irritant poisoning. The body was then (eleven days after death) exhumed, and the viscera forwarded for analysis, when about twenty grains of arsenious oxide was found in the contents of deceased's stomach.—*Bombay Chemical Analyser's Report*, 1880-81.

Case.—**Homicidal poisoning by colchicum.**—Catherine Wilson was tried and convicted of the murder of a Mrs. Soames, who six years previously had died suddenly while being nursed by her. It was proved that, besides Mrs. Soames, three other persons had died suddenly after the administration to them by the prisoner of food or medicine. In all four cases the symptoms were similar in character, viz. burning pain in the throat and stomach, intense thirst, violent vomiting and purging, collapse, and death from exhaustion without convulsions or loss of consciousness. In each of the four cases, also, the symptoms came on suddenly while the affected individuals were in a state of health, and in each case the death of the individual affected enabled the prisoner to acquire money or property. In each case the body of the deceased individual was exhumed, in one case within two months, in another about one and a half years, and in the other two six years, after death, but in all four cases no poison could be detected on analysis of the viscera.—*R.* v. *Catherine Wilson.* Taylor, *Poisons*, p. 512.

6. Appear in persons previously in good health.—This character may obviously be absent in cases of poisoning, or present in cases of disease. 7. Prove rapidly fatal.—This character, like the last, is one which may be absent in poisoning and present in disease.

Obviously the greater the number of the above characters present in the same case, the stronger is the suspicion of poisoning; and *vice versâ*, the smaller the number, the weaker the indication of poisoning.

Special symptoms of poisoning vary with the class to which the poison belongs.

1. **Irritant poisons,** see p. 465, etc.—Certain diseases are accompanied by symptoms more or less resembling in special character those of poisoning, *e.g.*: The chief affections simulating the effects of poisons of this class, are:

(*a*) **Cholera.**—This is specially liable to be mistaken for arsenical poisoning, and *vice versâ* (see *Arsenic*, p. 487). (*b*) **Gastritis,** following the imbibition of a large quantity of cold fluid, whilst the body is cooling after violent exertion (see *Case*, p. 454). Or, under such circumstances, death may occur from shock (see *Case*, p. 454), and the case resemble one of rapidly fatal narcotic poisoning, *e.g.* by hydrocyanic acid. Idiopathic gastritis is very rare, and is not accompanied by the violent purging usually present in irritant poisoning. (*c*) **Rupture of stomach,** complete or partial, especially when

due to over-distension (see *Case* below), may closely simulate irritant poisoning. So also may perforation of the stomach from disease, rupture or perforation of the intestines and rupture of the biliary ducts, uterus, or uterine appendages. In cases such as these the *post mortem* appearances will indicate to what the symptoms have been due. (*d*) **Colic.**—There may be some difficulty in diagnosing this from acute irritant poisoning, especially by lead salts. Pressure, however, in acute irritant poisoning augments the pain, while in colic it often relieves it. (*e*) **Enteritis**, peritonitis and intussusception.—These affections, like acute poisoning by lead salts, are accompanied by constipation. Unlike irritant poisoning, in the later stages of these affections, vomiting, if present, becomes stercoraceous.

Case.—**Rupture of the stomach;** symptoms like irritant poisoning.—A boy aged fourteen, after eating and drinking heartily at a feast, was attacked with violent vomiting and purging. Next morning he was unable to swallow, his pulse became irregular, and pressure on the heart or stomach caused excruciating agony. These symptoms continued, and on the following day, after having vomited at intervals altogether about two pounds of blood, the boy died. On *post mortem* examination, the inner coat of the stomach was found torn in many places, and that of the duodenum lacerated almost completely round.—Taylor, *Poisons*, p. 118.

2. **Cerebral poisons** (see Chap. XXX.).—The chief affections simulating the effects of these are:—(*a*) Apoplexy and uræmic coma.—These may more or less resemble poisoning by opium, or narcotics similar in action thereto (see *Opium*). (*b*) Epilepsy.—A fatal attack of this affection might possibly be mistaken for hydrocyanic acid poisoning. Death, however, seldom results from a first attack of epilepsy, and a history of previous attacks would indicate the nature of the case. (*c*) Sudden death from heart disease.—This may be mistaken for hydrocyanic acid poisoning, or for one of those cases which sometimes occur, of death by syncope from a single over-dose of chloral. The presence of *post mortem* appearances of advanced heart disease would, of course, tend to indicate death from disease. In some cases of sudden death from heart affection, however, no marked appearances of the heart are discoverable after death.

3. **Spinal poisons** (see Chap. XXIX.).—The effects of poisons of this class may be more or less simulated by—(*a*) Tetanus.—This closely resembles strychnine poisoning (which see). (*b*) Cerebro-spinal meningitis. This affection is accompanied by tetanic spasms, more or less resembling those of strychnine poisoning. Unlike strychnine poisoning, headache,

fever, hyperæsthesia, and delirium precede the tetanic symptoms. (*c*) Convulsions in young children proving (as sometimes happens) rapidly fatal may simulate poisoning, the more so as opium poisoning in children is often accompanied by convulsions. In some cases the attack may be traced to dentition, indigestion, worms, or other source of irritation, but sometimes no cause for the attack is discoverable.

4. **Cardiac poisons** (see Chap. XXX.).—The effects of a poison of this class may be simulated by heart disease (see above), or by sudden death from embolism, especially of the pulmonary artery. In this last case, the discovery of a plug obstructing the affected vessel would indicate the cause of death.

2. Post Mortem Appearances in Poisoning.

Many poisons leave no characteristic *post mortem* appearances, but irritant poisons usually leave well-marked signs of their action. Such signs may consist in the presence of—

1. **Redness of the mucous membrane of the stomach** and other portions of the alimentary canal, due to inflammatory action. Such redness may be the result of disease, but is usually the result of the administration of an irritant poison. When due to poisoning, the redness may vary in degree from unusual vascularity to a deep red velvety appearance. The mucous membrane is softened and opaque, and may show dark patches, due to underlying extravasated blood. Often its surface is covered with a glairy tenacious mucus, in which particles of the poison may be found entangled. Usually, in irritant poisoning, these appearances are chiefly met with in the stomach. Redness due to inflammatory action may be more or less simulated by—

(*a*) **Staining** with red dyes.—Chemical tests will usually distinguish this, most vegetable reds being turned either blue or green by alkalies or yellow by acids. Examination under the microscope also will, in such cases, show that the redness is not due to distension of the blood vessels. (*b*) **Congestion.**—In some cases of sudden death, especially from congestion of the brain, or from cardiac disease,[1] the mucous membrane of the stomach is found congested, and patches even of extravasated blood have been found beneath it. On dissection, the mucous

[1] In death from heart diseases the condition of the stomach mucosa frequently bears a striking resemblance to the condition in gastritis or irritant poison, so much so that Prof. Powell is in the habit of calling a condition of deep injection with patches of punctate ecchymosis, the "cardiac stomach."

membrane is found to be tough and transparent, and not as in irritant poisoning, softened and opaque from inflammation.

2. **Discolorations** other than redness of the parts with which the poison has come into contact.

In some cases such discolorations are met with in the alimentary canal. Thus, in arsenical poisoning, yellow patches, due to conversion of arsenious oxide into sulphide, are often found on the mucous membrane; and in cases of copper poisoning a blue or green coloration may be found. In cases of corrosive sublimate poisoning, such as by Burroughs Welcome's soloids of mercury perchloride, green discolorations may be found on the mucous membrane of the alimentary canal and on other parts, *e.g.* the skin.

3. **Ulceration** of the mucous membrane of the stomach.—Ulceration from disease must not be mistaken for this.

Generally, but not always, in disease, the ulcer is only just surrounded by redness, the symptoms are slight, and, unless due to malignant disease, the individuals affected are generally young women—from eighteen to twenty-three years of age. In irritant poisoning the redness, as a rule, is diffused over the whole stomach, particles of the poison may be found adhering to the ulcer, the ulceration may extend into the duodenum, and the symptoms are severe.

4. **Corrosion or chemical destruction** of the tissues, *and perforation of the stomach.*—In cases of corrosive poisoning marks of corrosion may be found on the skin, or in the mouth, throat, or œsophagus, or on the mucous membrane of the stomach. Perforation of the stomach may be found; this, however, is comparatively rare in poisoning.

Post mortem softening of the stomach, with or without perforation due to the action of the gastric juice, is sometimes met with, and must not be mistaken for corrosion. In such *post mortem* softening, dependent parts of the stomach, and sometimes neighbouring organs, are affected. There is no inflammatory redness, and the mucous membrane is gelatinous and transparent. The extent of the softening, also, is likely to be greater the longer the period which has elapsed since death.

5. *Post mortem* appearances of irritation may also be found in the air passages, in cases of poisoning by volatile or gaseous irritants, *e.g.* ammonia and hydrochloric acid; and in the case of certain irritant poisons, *e.g.* cantharides, in the kidneys or urinary passages. A yellow tinge of the skin is a common *post mortem* appearance in acute poisoning by copper and phosphorus, and in the latter, fatty degeneration of the liver is almost always present.

Some non-irritant poisons, *e.g.* hydrocyanic acid, emit, on opening the body, a particular odour, which may indicate the nature of the case. In others during the *post mortem* examination, portions of the poison used, *e.g.* datura seeds, may possibly

be found and identified. In the great majority, however, the *post mortem* appearances present merely indicate the 'mode' of death (coma, asphyxia, etc.), and are therefore consistent with death from causes other than by poisoning.

Directions for making a Post Mortem Examination in a Case of Suspected Poisoning.

The chief points requiring special attention are :—

1. **Examine the state of the pupils.**

2. **Examine surface** and orifices of the body, especially the mouth and throat, for marks of corrosion.—This is most important. It frequently happens that in corrosive poisoning, chemical analysis can do no more than prove the existence in the viscera of a salt, *e.g.* a sulphate or an oxalate, which may have been derived from the poison swallowed, or may have been introduced into the body as a constituent of an article of food or medicine. In such a case failure to examine the mouth and throat for marks of corrosion may make it impossible to prove that death was due to poison.

3. **Stomach,** mucous membrane and alimentary canal should be examined at the time the *post mortem* inspection is made. Appearances indicative of the action of a poison are liable (from decomposition, or from the action of preservative fluids) to disappear from the mucous membrane. Hence, after removal of the stomach and intestines, these should be cut open, and their internal appearance noted. Suspicious particles found adhering to the mucous membrane of the stomach should be picked off, and preserved separately. (See rules in *Appendix XVI.*)

4. **Preserve matters for analysis.**—In addition to the stomach, its contents, and the contents of the intestines, one kidney, and a portion of the liver, at least 1 lb. in weight, also the urine, should always be preserved. Failure to preserve a portion, or a sufficient portion, of the solid viscera, may result in entire failure of the chemical analysis. Thoroughly clean vessels alone should be used, see p. 461. For the purpose of preventing decomposition, spirit should be added to the matters preserved (except, of course, to fluid matters, in cases of suspected alcoholic poisoning) or a saturated solution of common salt may be used in certain cases. It is desirable to retain a sample of the spirit or salt-solution used, in case any question should arise in regard to its purity. The vessels containing the

matters preserved for analysis should be sealed, and care taken to prevent their being tampered with.

5. **Transmit articles for analysis.**—To secure identity, the containing vessels should be properly labelled, and an impression of the seal used in closing them (which, of course, should be a private seal), enclosed in the letter advising their despatch. The box containing the vessels should be franked. A summary of the case should always be forwarded to the analyst. It must be recollected that the quantity of matter available for analysis is limited, and that the quantity of poison present is frequently very small. Sub-division, therefore, of the matters under examination is to be avoided as much as possible, and this cannot be the case if the analyst is given no guide to the class of poison to be searched for, and as a rule he cannot begin his analysis until the full report is received by him.

6. **Examine rest of the body.**—This should never be neglected. It should be remembered that even in cases where the suspicion of poisoning is strong, death may have been due to causes other than the administration of poison. Also that *post mortem* appearances, indicative of disease or injury, may be found co-existing with appearances indicating death from poison; and that in such cases the fact of the existence of the disease or injury may, even when death has been clearly due to poison, be important as bearing on the question of suicide or homicide. In the case of female bodies care should always be taken to examine the vagina. Poisonous matters, or traces left by their action, are frequently found in the vagina, in cases where death has been the result of an attempt to procure abortion. Even also in other cases poison may be found in the vagina (see ' Opium Poisoning ').

3. Chemical Analysis.

This is usually performed by an expert chemist, as the ordinary medical man has not the requisite technical skill or appliances for the delicate processes necessary. The object of chemical analysis is to ascertain (1) the presence and character of the poison, (2) if possible, the quantity of poison taken, and (3) how the poison was administered, etc. The detection of poison in the body is the most important proof of poisoning, it is improbable to have been introduced after death—if found deposited in the solid organs could not have been so. When poison is found there is the question whether it was the cause of death, for death may be the result of other injury, etc. On

the other hand, poison may disappear from the body by vomiting, purging, or by the urine or be decomposed. Poisons, after absorption, tend to undergo elimination by natural effort, *e.g.* by the lungs, skin, or kidneys. Hence, during life, in cases of poisoning, poisons may be detected by analysis in the **urine,** and if, in a case of poisoning, life is prolonged for some time, no poison may, after death, be discoverable in the body. The longer life is prolonged, and the more soluble or volatile the poison, the more likely is this to occur. Complete elimination has been known to take place, in a case of arsenical poisoning, in a fortnight; and, in a case of antimonial poisoning, in a week; and may occur very rapidly in the case of very volatile poisons, like hydrocyanic acid and chloroform.

Poison may be detected by analysis:—(*a*) *Before death* in the (1) vomit, (2) urine or in other evacuation; (3) or in food, or other suspected articles. (*b*) *After death,* in the contents of the stomach or intestines; or, owing to absorption, in the liver, kidneys, or other parts of the body.

The longer the duration of the case, the less likely is it that any of the poison will be found after death in the contents of the stomach; and the more likely is it that if poison is detected at all in the body, it will only be found in some solid viscera. Hence the importance of submitting portions of these to analysis. For the composition of poisonous proprietary medicines, see Martindale & Westcott's Extra Pharmacopœia II.

When a poison is found, it does not necessarily imply poisoning. Poison may be introduced into an article of food, in order to support a false charge. Again, poison may be introduced into evacuations, or even into viscera, with a similar object; or these may have become accidentally contaminated with poison from impurities in the containing vessel. Hence the importance of (1) if possible, securing for analysis vomit, etc., ejected in presence of the medical attendant; (2) using only thoroughly clean vessels holding matters to be analysed, and (3) preserving such matters under seal, etc., so as to prevent their being tampered with. Suppose, however, that poison is found, and that such poison has not been introduced in one of the ways indicated above, the case may still not be one of poisoning, because the poison discovered—

(*a*) **May be a natural constituent** of articles of food, *e.g.* oxalic acid in combination is found in certain vegetables; or, (*b*) May **have been given** in the course of **medical** treatment, *e.g.* arsenic or mercury (see these poisons). In two other cases also, a poison, or substance resembling a poison, may be found in the viscera of an individual, and the case yet be not one of death from poison, viz.:—(*c*) **When death has been due** to

some **other cause,** *e.g.* drowning or hanging, operating before the poison has fully exerted its action on the system; or, (*d*) **When the substance found** is a **'Ptomaine,'** or alkaloid resulting from decomposition (see 'Ptomaines').

The total quantity of poison found in the viscera of an individual may be less than a minimum poisonous dose, and the case may yet be one of death from poison. Frequently a large proportion of the poison swallowed is got rid of by evacuation. In this way, the whole alimentary tract may be freed from the poison, and only that portion which has been absorbed remain in the body. This absorbed portion again is distributed more or less throughout the whole body. Obviously, however, only a fractional part of the body can be examined, and the quantity of poison found in this, therefore, is only a fraction of the quantity the body contains. Again, by elimination through the emunctories during life, a portion, or even the whole of the absorbed poison, may be removed from the body, and yet death occur from the effects of the poison. In such a case, the whole body may not contain such a quantity of the poison as amounts to a minimum fatal dose.

On the whole, therefore, the quantity of poison found in the body is, in the great majority of cases, of little importance. In a few cases, however, it may be important, *e.g.* when the quantity found is small, and the poison is one sometimes present as a natural constituent of food, or sometimes given as a medicine. Hence, where possible, the quantity present should always be determined.

When no poison is found, the case may yet be one of poisoning, under the following circumstances:—

(*a*) **From the poison** having disappeared by evaporation or by evacuation or elimination. This, as already pointed out, is specially likely to occur in the case of very volatile, *e.g.* gaseous poisons; or in the case of very soluble poisons, *e.g.* in poisoning by the corrosive acids; or in case where an individual has lived for some time after swallowing the poison. (*b*) From neglect to submit certain matters (or a sufficient quantity thereof) to analysis, *e.g.* in cases where the individual has lived for some time after administration of the poison, and no portion, or only very small portions, of the solid viscera, are submitted to the analyst. Again, of several articles of food, one alone may contain poison, and this may not have been submitted. (*c*) From the poison having undergone chemical destruction by oxidation or putrefaction. This may occur in the case of organic, but not in the case of inorganic poisons. It is possible that some organic

poisons may undergo destruction by oxidation in the body during life. Organic poisons, again, may be destroyed by putrefaction after death; some, however, *e.g.* strychnine and opium, have been found to resist putrefaction for long periods. (*d*) From there being no reliable means of extracting the poison from substances containing it, or no satisfactory tests for its identification. (*e*) From want of care or skill on the part of the analyst.

The case of *R.* v. *Catherine Wilson* (p. 455) is an example of a conviction for murder by poison, notwithstanding the fact that no poison was discovered in the viscera of the persons poisoned.

Should a poison be found, a portion of it should, if possible, be preserved for production before the Court (*Ind. Evid. Act*, s. 60).

4. Test-Experiments on Lower Animals.

The evidence from experiments on animals, the 'physiological test,' with the contents of the stomach and vomited matter or extracts from these, may take the form of—

1. **Administration of suspected substances,** such as portions of (*a*) Food.—This is often employed as a rough preliminary test for the presence of poison. (*b*) Vomited matter.—An experiment of this kind is sometimes the result of accident, and is open to the fallacy that morbid secretions, *e.g.* bile, may, when swallowed by animals, cause symptoms of poisoning. (*c*) Eliminated poison.—This is especially useful in the case of organic poisons for which there are no distinctive chemical tests, *e.g.* aconitia and daturia (see, however, remarks on 'Ptomaines').

This is the ordinary physiological test for aconite and datura—the extract by *Stas'* or other process for extracting alkaloids is put into the eye of a cat, or administered internally to a cat by the stomach-pump.

2. **Comparison experiments.**—In the case of suspected poisoning by a substance the action of which is not well known, it may prove useful to administer to an animal a dose of the poison supposed to have been employed, so that the symptoms present in the case may be compared with those which arise in the animal experimented on. Experiments of this kind are open to two objections.

(*a*) Some animals are apparently unaffected by poisons, which act violently on man, and herbivora are as a class less affected than carnivora, *e.g.* pigeons appear to be unaffected by opium, some varieties of monkeys appear to be unaffected by

strychnine, and rabbits appear to be unaffected by belladonna, and fowls by strychnine. It should be noted, however, that poisoning in the human subject may arise from eating the flesh of animals that have fed on plants not poisonous to the animal, but poisonous to man. (*b*) The symptoms produced in the animal experimented on may be different from those of the case, although the same poison was used in both; either from the action of the poison on the animal being different to its action on man, or from failure to properly proportion the dose to the size of the animal.

The weight of the animal used in the experiment should always be recorded with the weight or quantity of suspected poison administered. In every case a '*control*' experiment should be made on a second animal of the same species, and as far as possible of the same size and weight.

CHAPTER XXIII.

CORROSIVE AND IRRITANT MINERAL POISONS.

General Symptoms of Irritant Poisoning.

THESE are divisible into (*a*) Throat symptoms; (*b*) Abdominal; and (*c*) Later symptoms. (*a*) Throat symptoms.—These are pain, difficulty in swallowing, and feeling of constriction; and (in corrosives) marks of corrosion in the mouth and throat. (*b*) Abdominal symptoms.—These are epigastric pain, thirst, nausea, vomiting, purging, tenesmus, and dysuria. The stools and vomited matters often contain blood. (*c*) Later symptoms. —These are acute inflammation of parts, pain, and inflammatory fever; or collapse accompanied by a quick feeble pulse, and cold sweats; sometimes the anus becomes excoriated. Various symptoms due to the specific remote action of the poison may also be present, and in cases which survive, stricture of the gullet may result.

The order in which the symptoms appear varies according as to whether the case is one of corrosive, or of non-corrosive irritant poisoning. In corrosive poisoning, the throat symptoms appear first, and come on immediately, or almost immediately, and often the glottis and trachea are affected, causing dyspnœa. In non-corrosive irritant poisoning, the abdominal symptoms appear first, and are followed by throat symptoms. In non-corrosive irritants, the interval between swallowing the poison and first appearance of the symptoms varies; it may be very short in the case of the more soluble irritants, or may be half an hour or more in the case of less soluble ones.

Death may occur.—(*a*) Rapidly from shock, as in some cases of arsenical poisoning; or from suffocation, as in some cases of corrosive poisoning. (*b*) Less rapidly from syncope due to absorption and secondary action, as in some cases of oxalic acid poisoning. (*c*) Still less rapidly from exhaustion due to protracted irritation; or (*d*) In corrosive poisoning, after

a considerable period, from starvation or suffocation, the result of local injury.

Post mortem appearances of irritant poisoning are signs of irritation or corrosion of the mucous membrane of the alimentary canal. In some cases, similar signs may be present in other situations.

Treatment.—In cases of irritant poisoning, the following indications should be followed:—1. **Elimination.** Usually there is free vomiting, which should be encouraged by copious draughts of warm water. In some cases, emetics or the stomach-pump may be required; the latter, however, should never be used in corrosive poisoning. 2. **Prevention** of action —The means whereby this indication may be carried out have already been sufficiently indicated (see *ante*, p. 452). Here it may be noted that, in the case of vegetable and animal irritants, antidotes are, as a rule, not available. 3. **Counteraction** and removal of effects.—Under this head the employment of measures calculated to allay irritation—among them administration of demulcents—is indicated. Oily demulcents must not be given in poisoning by phosphorus, or by cantharides, these poisons being soluble in oil. Stimulants may be given to counteract depression. In cases of corrosive poisoning, laryngotomy may be required.

Irritant poisons may be conveniently classified as:—(1) Corrosive poisons including mineral acids and alkaloids; (2) Non-metallic irritants and organic acids; (3) Metallic irritants; (4) Vegetable irritants; (5) Animal irritants; and (6) Mechanical irritants.

Corrosive Mineral Acids.

The chief of these are:—Sulphuric acid or oil of vitriol, hydrochloric or muriatic acid or spirit of salt, nitric acid or aqua fortis.

Action, and origin of cases.—These three acids are very similar in action, and are powerful corrosives, except when much diluted, when they act as simple irritants. Cases of poisoning by them are rare in India,[1] but tolerably frequent in Europe. Owing to their marked properties, these acids are seldom used homicidally; a few cases, however, of homicidal

[1] Only one case (suicide by nitric acid) occurred in the Bombay Presidency in twenty years.

poisoning of children by sulphuric acid are recorded. Accidental cases, except among children, also are rare. Most commonly adult cases of poisoning by these acids are suicidal, and in England form about one-twelfth of the total suicides by poison. Sulphuric acid has been injected by mistake into the rectum as an enema, and has been thrown up into the vagina for the purpose of procuring abortion. Not infrequently in England, and in rare cases also in India, sulphuric acid is thrown over the person in order to cause injury ('vitriol throwing'). Sometimes nitric acid is used in the same way. A few accidental fatal cases from inhalation of the vapours given off by nitric acid (see *Nitrous Acid*) have occurred; and a case of homicide by pouring nitric acid into the ear during sleep is on record.

General Symptoms.—Swallowed in a tolerably concentrated condition these acids cause: Immediate burning pain in the mouth and throat, followed by pain in the abdomen. Vomiting of brown or black matter containing blood, mucus, and shreds of mucous membrane. The vomited matters, especially those first ejected, may effervesce on coming into contact with the ground (owing to the acid acting on carbonates). There is tenesmus, but no purging; difficulty and pain in micturating, in swallowing, and often also in breathing. The lips and interior of the mouth, unless the poison has been conveyed to the back of the throat by a spoon or some such means, are discoloured, or shrivelled and blistered. The discoloration, at first white, afterwards becomes ash-grey or brown, or, if nitric acid has been employed, turns yellow. Marks of the action of the acid may be found on the skin or clothes; these are stained yellow if from nitric acid, and brown —or, if on coloured cloth, dull red—when due to sulphuric acid. Hydrochloric acid does not stain the skin, but stains coloured cloth very much like sulphuric acid.

Special symptoms:—

Sulphuric acid.—Salivation coming on about the second or third day has been observed in several cases. In exceptional suicidal cases there has been considerable delay in the appearance of serious symptoms (see two undernoted cases), and in one case vomiting ceased in four hours, and did not return, although the patient lived thirty-one hours. In a few cases sulphate of indigo—a solution of indigo in strong sulphuric acid, used in dyeing—has been taken, giving rise to symptoms exactly like those of sulphuric acid poisoning; except that the mouth and vomited matters, and in some cases the urine also, are tinged blue.

Cases.—**Poisoning by sulphuric acid; (*a*) appearance of urgent symptoms delayed.**—A man, *æt.* fifty-six, swallowed by mistake a dessert-spoonful of oil of vitriol. On admission into hospital, he was able to walk upstairs. He vomited slightly at first, did not appear very ill, had one brown fluid motion. The lining membrane of the mouth was brown. There were no urgent symptoms, but the patient died suddenly on the fourth day.—(Taylor, *Poisons*, p. 183). (*b*) A girl having swallowed a quantity of concentrated sulphuric acid, sat quietly down to tea with some friends, although the quantity of acid taken was sufficient to cause death in a few hours.—*Ib.*

Hydrochloric acid.—In one case of poisoning by this acid salivation came on rapidly, in another convulsions preceded death, and in a third delirium came on on the second day, followed by paralysis of the limbs. The vapour of hydrochloric acid if inhaled acts as a poison, causing great irritation of the air passages.

Case.—**Hydrochloric acid poisoning.**—In 1897 a man in Calcutta was advised to purchase half an ounce of hydrochloric acid from a baniah's shop, and to take it with some water for the cure of some disease from which he was suffering. He drank the strong undiluted acid, and died from its effects after exhibiting all the symptoms of corrosive poisoning. The mucous membrane of the stomach was superficially charred at several places, and yellow patches were found in mucous membrane of the throat and gullet. No free acid was found in the stomach, as he was treated with alkaline medicines in the hospital. Sulphates were detected in the viscera, but abundance of hydrochloric acid, in combination with alkaline metals, was found in them as well as in the washings of the stomach received with the viscera. No nitric acid was detected.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Nitric acid.—The immediate effect of nitric acid on the living tissues is to coagulate the albumen. The strong acid produces a yellowish compound, *xantho-proteic acid,* which forms the typical yellow stain of this acid on the skin, mucous membrane, or clothes. In one case of poisoning by this acid lockjaw was present, and in another insensibility.

Case.—**Nitric acid poisoning—accidental.**—A Hindu in Calcutta drank by mistake for medicine some nitric acid which he had obtained to clean gold, and died from irritant poisoning. The pharynx and œsophagus were found corroded and softened, stomach perforated in two places, which were filled with clotted blood. Nitric acid and nitrates were found in the viscera.—Hamnath Adhikari, *Beng. Chem. Exr's. Rept.*, 1919.

A case is recorded of poisoning by a mixture of nitric and sulphuric acids. **Nitromuriatic acid** is used in the arts for dissolving gold and other purposes, but does not seem to have given rise to any cases of poisoning.

Symptoms in acid poisoning.—Death may occur rapidly from shock or suffocation. Children poisoned by sulphuric acid

often die from the latter cause, the poison never reaching the stomach. Hydrochloric acid poisoning also is apt to end in death by suffocation, due either to spasm, or later to corrosion and œdema of glottis. Death may take place less rapidly from exhaustion; or, after months, from starvation, due to stricture of the œsophagus. In the case before referred to, where nitric acid was poured into the ear, death took place in thirteen weeks, from necrosis and inflammation spreading to the brain. Death usually takes place within twenty-four hours, but has occurred (in nitric acid poisoning) in an infant in five minutes, and in an adult in one hour and three-quarters. The longest fatal periods recorded are, in sulphuric acid poisoning, forty-five weeks, and in nitric acid poisoning two years, both from starvation, due either to stricture of gullet or to destruction of the peptic glands.

Fatal dose.—The more concentrated the form in which these acids are swallowed the more likely is a given quantity to cause death. A very few drops of any of the three acids may cause death from suffocation; and the more empty the stomach, the more likely is serious injury to it to result. Hence the least quantity required to destroy life cannot be precisely stated. The smallest doses which are recorded to have proved fatal are sulphuric acid, 1 drachm; nitric acid (in a child of thirteen), 2 drachms; and hydrochloric acid, about ½ ounce. The largest non-fatal dose of sulphuric acid recorded is 3 ounces; and several instances of recovery after swallowing an ounce of hydrochloric acid are reported. **Post mortem appearances.**—These are usually: marks of the acid, as before described, on the clothes, skin and lips, and in the mouth. Signs of inflammation and corrosion in the œsophagus, and sometimes in the larynx. Stomach in the majority of cases discoloured (yellow from nitric acid, brown or black from the other two acids), inflamed, corroded, and sometimes perforated. Marks of the action of the acid may be absent from the mouth, if the acid has been poured down the throat with a spoon; absent, or nearly absent, from the œsophagus, even although the poison has reached the stomach; and even in fatal cases, altogether absent from the stomach. **Perforation of the stomach** has been found in about one-third of the fatal cases of sulphuric acid poisoning, is rare in nitric acid, and still rarer in hydrochloric acid poisoning.

Treatment.—The stomach-pump must **not** be used. Give calcined magnesia, carbonate of magnesia, chalk, or carbonate of soda, followed by mucilaginous drinks. If death from suffocation threatens, laryngotomy must be performed. In the after treatment leeches and other antiphlogistic remedies may be required. Excoriations should be washed with lime-water and treated as burns. Distress due to inhalation of hydrochloric acid vapour may be relieved by inhalation of weak ammonia.

Detection.—In fatal cases of poisoning by these acids, especially if life has been prolonged for two or three days,

no trace of the poison may be discoverable in the viscera. Should the presence of one of these acids be detected, it is important—salts of these acids being common constituents of food and medicine—to ascertain whether any of it is present in the free condition. If no free acid be found, the quantity of **combined** acid present becomes of importance. The quantity of **free** acid present is specially important in hydrochloric acid poisoning, as this acid (in loose combination with pepsin) is contained uncombined with bases in the gastric juice to the extent of about 0·2 per cent. or more.

Sulphuric acid and solutions of sulphates give a white precipitate with barium nitrate, which is (1) insoluble in dilute nitric acid, (2) insoluble in water, and (3) when collected, dried, and heated with powdered charcoal before the blowpipe, converted into barium sulphide, soluble in hydrochloric acid with escape of hydrogen sulphide, recognized by its odour, and by its blackening paper wetted with lead acetate solution. Free sulphuric acid chars organic matter. It may be separated from soluble sulphates by concentration on a water bath and treatment with quinine; separating the quinine sulphate formed, after thorough drying, by strong alcohol, in which quinine sulphate is soluble, but alkaline and metallic sulphates are insoluble. The alcoholic solution is then to be evaporated to dryness, the residue dissolved in boiling water, decomposed by ammonia, filtered, and the sulphuric acid estimated in the filtrate by precipitation as barium sulphate.

Hydrochloric acid and solutions of chlorides give (1) a white flocculent precipitate with silver nitrate solution, soluble in ammonia, but insoluble in boiling nitric acid, and (2) when boiled with H_2SO_4 and manganese dioxide, evolve chlorine, recognizable by its colour, odour, and bleaching action on moistened litmus paper. Free hydrochloric acid evolves chlorine when boiled with manganese dioxide only, and when mixed with HNO_3 dissolves gold. Organic mixtures to be tested for the free acid should be distilled, and the distillate tested for HCl; or if this, as sometimes happens, fails, resort may be had to either (1) the quinine process as for sulphuric acid described above, estimating the chlorine in the decomposed filtrate volumetrically with silver nitrate solution; or (2) the organic mixture may be divided into two equal portions, and one of these neutralized by solid carbonate; both are then evaporated to dryness, the residues incinerated, and the chlorine in each separately estimated. The excess of chlorine in the neutralized portion corresponds to the free acid present in the original fluid.

Nitric acid and solutions of nitrates (1) heated with H_2SO_4 and fragments of copper dissolve the copper with escape of lower oxides of nitrogen, known by their red colour and their liberating iodine from potassium iodide ; (2) boiled with H_2SO_4 and a drop or two of indigo solution, decolorize the indigo (this test by itself is not conclusive evidence of the presence of HNO_3); and (3) if to a portion of the solution under test, ferrous sulphate solution and then a little H_2SO_4 be cautiously added, a brown ring appears at the point of contact of the H_2SO_4 with the other fluids. Free nitric acid gives the above reactions without the addition of H_2SO_4, and if mixed with HCl dissolves gold. It may be separated from organic mixtures by the quinine process described above for sulphuric and hydrochloric acids.

Stains on cloth, etc.—The yellow stains of nitric acid on the tissues or on cloth, treated with weak caustic potash solution, acquire an orange colour, while iodine stains disappear, and bile stains remain unaltered. Stains of sulphuric or hydrochloric acid on dark-coloured cloth are usually reddish, the red tint disappearing on addition of ammonia. Sulphuric acid stains are more moist, and show more evidence of corrosion, than hydrochloric acid stains. Stains on cloth, etc., should be macerated in water, which will acquire an acid reaction if free acid is present in the stain. The watery solution may then be tested for the suspected acid. A comparison experiment should at the same time be made with an unstained portion of the cloth. Burns must not be mistaken for marks of corrosion by sulphuric acid. Blyth, on the authority of Maschka, mentions a case where free sulphuric acid found in a charred mark on an infant's bed was ascertained to be due to the sudden quenching with water of a live coal which had fallen thereon.

The detection of these acids may be required in criminal cases other than cases of poisoning or causing actual bodily hurt, as in a case where a bottle of this liquid, loosely stoppered and leaking, was sent by post, and a prosecution under the Post Office Act thereupon instituted against the sender. A mixture of HNO_3 and H_2SO_4 is used in making nitro-glycerine and other explosives ; the identification of these acids, therefore, might be required in support of a charge of illicitly manufacturing such substances. Nitric acid is used in India for the purpose of ' sweating ' silver coin ; the method employed being apparently to steep the coins for a short time in this acid, and then, by adding metallic copper, precipitate and recover the silver. Hydrochloric acid has been used in forgery, to remove marks of writing ink from paper. Hydrochloric acid

gas acts injuriously on vegetation, and by law in England alkali manufacturers—making carbonate of soda by the salt cake process—render themselves liable to penalties if they fail to condense to a stated extent the hydrochloric acid evolved in the manufacture. Hydrofluoric acid, HF, used for etching on glass, is a powerful corrosive. One fatal case is recorded of poisoning by this acid, in which half an ounce was swallowed, and death took place in thirty-five minutes.[1]

Alkaline Corrosives.

The chief poisons of this class are the caustic alkalies: **potash, soda, and ammonia and their carbonates.** These, like the acid corrosives, act as simple irritants when sufficiently diluted. Cases of poisoning by the alkaline corrosives are rare, and usually accidental. One fatal case occurred in Bombay in twenty years, namely, a case of suicide by caustic ammonia.

In Europe, cases of poisoning by the corrosive alkalies are commonly accidental, and owe their origin to the extensive use of these substances in the arts, especially carbonates of potash and soda. Impure carbonate of soda is sold in the bazaars of Bombay under the names of *Sajjikhara* and *Bangadakhara;* impure carbonate of potash, as *Javakhara*, and the mixed carbonates as *Papadakhara.*[2]

Symptoms.—These are similar to those caused by the corrosive acids, except that the vomited matters are alkaline and do not effervesce on the ground, and purging—which is not common in poisoning by the corrosive acids—is a frequent symptom in alkaline poisoning. In poisoning by liquid ammonia or its vapour, and by the carbonates of ammonia, inflammation of the air-passages is a constant symptom. Caustic ammonia is less corrosive than caustic potash and caustic soda, and carbonate of soda is less corrosive than carbonate of potash. As in poisoning by the corrosive acids, the greater the degree of concentration of the poison, the greater the danger. The *post mortem* signs and modes of death are similar to those in poisoning by the corrosive acids.

Treatment also is the same, except of course that dilute acids, preferably dilute vegetable acids, should be given instead of dilute alkaline solutions. In poisoning by ammonia inhalation of acetic acid vapour may be used to allay irritation of the air-passages.

[1] See *Physiological Action of Hydrofluoric Acid and Fluorides*, by L. A. Wardell, M.B.—*Ind. Med. Gaz.*, 1883.

[2] Sakharam Arjun, *Catalogue of Bombay Drugs.*

Fatal dose, etc.—Forty grains of caustic potash caused the death of an adult in seven weeks from exhaustion. About half an ounce may be looked on as an ordinary fatal dose of caustic potash or caustic soda, and about half an ounce of carbonate of potash has in more than one instance, in adults, caused death in two to four months. Carbonate of soda is much less poisonous: a case of recovery after swallowing twelve ounces is on record. Of caustic ammonia a quarter of an ounce of the strong solution has caused death, and half an ounce may be regarded as an ordinary fatal dose.

Liquor potassæ (B.P.) contains 5·84, and liquor sodæ (B.P.) 4·1 per cent. of caustic alkali. Strong solution of ammonia (B.P.) contains 32½ per cent. and solution of ammonia (B.P.) 10 per cent. of NH_3. Compound camphor liniment (B.P.) contains about 7·3 per cent. of NH_3, and has given rise to more than one case of poisoning.

Detection.—Free potash and soda are most conveniently separated from organic mixtures by dialysis; after which the quantity present may be estimated (in the fluid which has passed through the membrane) by a standard acid. Free ammonia is best separated by distillation. Potash and ammonia are distinguished from soda by giving (1) a precipitate with tartaric acid in excess, and (2) a precipitate with platinic chloride in presence of hydrochloric acid. Ammonium may be distinguished from potassium salts (1) by their volatility, and (2) by their evolving ammonia when heated with solution of caustic potash.

Permanganate of potassium.—Fatal poisoning by permanganate of potassium appears to be very rare. Little or no reference is made in the current text-books on toxicology and forensic medicine to the poisonous action of permanganate of potassium.[1] The writers are only aware of one recorded case where death resulted from it. Several, however, have called attention to toxic symptoms following its use, and in the experience of one writer local sloughing followed the stupid and criminal procedure of subcutaneous injection in watery solution as an antidote for opium poisoning. Thomson (*Petersburger Med. Woch.*, 1895) records a case in which a large dose of solid permanganate of potassium caused corrosion of the pharynx and death in five hours from cardiac paralysis, which is quoted by Dixon Mann *apropos* of the use of solutions of permanganate in the treatment of poisoning by opium. Bidwell (*Boston Med. and Surg. Jour.*, vol. cxv. p. 141) quotes instances where serious symptoms followed the administration of permanganate of potassium. The sufferers were young unmarried

[1] See C. R. Fox, *Lancet*, p. 411, 1899.

females who were under treatment for amenorrhœa. In one case two consecutive doses of two grains were followed by intense burning pain from the throat to the pit of the stomach and serious collapse. In another a dose of one grain of the solid salt was followed by similar symptoms. In some correspondence (*Brit. Med. Jour.*, vol. i., 1895) on the possible dangers attending the use of this drug allusion is made to ulceration of the mouth attributed to local action of permanganate, and a case of abdominal pain and collapse following the administration is quoted by H. Powell. The actual quantity taken in the latter case is not clear. In another instance severe vomiting and collapse occurred after three two-grain doses had been taken at intervals. Judging from the condition of the coats of the stomach in their case no local mischief would have been inflicted by the use of the soft stomach-tube.

Case.—A woman, aged 47, after drinking heavily, took a 'handful' of crystals of permanganate of potassium and throwing them into a teacupful of beer drank the mixture. She was immediately taken to St. Thomas's Hospital. On the way she was said to have vomited. When seen she was pale, conscious, but was unable to speak. Her lips, chin, fingers, and the front of the right forearm were stained dark-brown. The tongue was quite swollen and almost black. The breath smelled strongly of stale beer. The skin was dry; the pulse was moderately rapid and of fair tension. After a few moments she struggled into a sitting posture and her breathing became slightly stridulous. Preparations were made for tracheotomy, but before anything could be done she fell back pulseless and the respiration stopped. By the stethoscope the heart could still be heard beating faintly and very slowly, although no pulse was perceptible at the wrist. Artificial respiration induced one or two respiratory movements. The heart sounds ceased altogether a few moments later. Death occurred 35 minutes after taking the poison. A necropsy was made 13½ hours after death. The chin, lips, and interior of the mouth were stained a deep brown. The front part of the tongue was swollen and almost black, the back part was of a deep mahogany colour. The epiglottis was blackened, the glottis was œdematous. The stomach was moderately distended and showed no signs of inflammation externally. It contained about two pints of fluid with which was mingled a black insoluble powder and some parchment-like masses—probably portions of food. The mucosa was coated with a black granular powder, closely adherent, which could not be washed off. On scraping away the incrustation the mucous membrane was found to be intensely hyperæmic, presenting a bright pink blush. The destructive action of the salt was evidently very superficial. A little of the black deposit had escaped into the duodenum. The mucous membrane here was also hyperæmic, but there was no incrustation. The liver was enlarged and appeared fatty. The portion of the spleen near the stomach was soft and pultaceous; the rest of the organ was normal.—C. R. Fox, in *Lancet*, p. 411, 1899.

Lime, CaO.—May be included among the alkaline corrosives, but from its little solubility is much less dangerous than the poisons just described. The symptoms, treatment, etc., are the

same as in poisoning by potash and soda. Malingerers have been known to produce ophthalmia by applying lime to the conjunctiva. **Other corrosive salts.**—Certain metallic salts, *e.g.* mercuric chloride and zinc chloride, possess a corrosive action : these will be described with the other compounds of these metals. A more or less destructive action on the tissues is also exerted by oxalic and acetic acid, see 'Vegetable Acids'; by bromine, see 'Non-metallic Irritants'; and by carbolic acid, see 'Narcotics,' group 2.

CHAPTER XXIV.

IRRITANT NON-METALLIC POISONS.

Phosphorus.

Red or amorphous phosphorus is not poisonous, whilst ordinary yellow phosphorus, especially in fine division, is an extremely active irritant poison. It is contained, about 1½ to 4 per cent., in various pastes used for destroying vermin, and to a varying extent, usually about 15 per cent., in the composition with which the heads of some kinds of lucifer matches are tipped.[1] Cases of poisoning by solid phosphorus usually arise from swallowing vermin pastes or lucifer match heads (see *Case* below), and are generally in adults suicidal, and in children accidental. Phosphorus vapour is also highly poisonous, but the symptoms produced by it usually differ from those of poisoning by solid phosphorus (see below).

Case.—**Phosphorus poisoning by match-heads.**—A case of attempted poisoning by phosphorus was reported from Purnea in 1897. The suspected substance consisted of a packet of betel-nut and a prepared *betel*, the pepper leaves (*pán*) mixed with catechu and lime for chewing. It was found to contain the tips of four lucifer matches. Phosphorus was detected in the match heads.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

The symptoms in acute poisoning may appear almost immediately, but in many cases do not appear for one to six hours; in a few cases their appearance has been delayed longer, and one case is recorded where five days elapsed before they appeared.

The first symptoms are those of ordinary irritant poisoning with the following points of difference: (1) the breath may be phosphorescent and have a garlicky odour; (2) the vomited matters and other evacuations may be phosphorescent; and (3) diarrhœa is sometimes absent. Subsequently jaundice sets in,

[1] In other kinds the non-poisonous red phosphorus is substituted for the poisonous yellow variety, and the heads of 'safety' matches contain no phosphorus.

usually before the end of the third day, often after a remission of the symptoms, and is accompanied most commonly by (*a*) retention of urine followed by fatal coma, delirium being sometimes present; or less commonly by (*b*) hæmorrhage from the mouth, bowels, and genito-urinary organs, and spots of purpura under the skin with death ultimately from exhaustions; or still more rarely by (*c*) cramps and fatal tetanic convulsions.

Death in a few cases occurs before the end of the second day and before jaundice has set in. Usually death takes place within a week. In one case the patient survived eight months. A little over one-ninth of a grain has caused death. Three-quarters of a grain to two grains may be looked on as an ordinary fatal dose; recovery, however, has been recorded after swallowing five grains.

Phosphorus vapour.—One or two acute cases of poisoning by phosphorus vapour are on record, but as a rule this form of poisoning is chronic in character. The chief symptoms present in chronic cases are caries of the teeth, and painful necrosis of the jaws, 'phossy-jaw,' most commonly of the lower jaw, followed in many cases by death from debility. Cases of this form of poisoning have chiefly been observed in workers in phosphorus, especially lucifer match makers: hence the term 'lucifer match maker's disease,' applied to this form of poisoning. Owing to improvements in the method of manufacture of lucifer matches, and specially to the introduction of red as a substitute for yellow phosphorus, cases of this form of poisoning are now much less frequent than formerly.

Post mortem signs.—In acute cases fatty degeneration of the liver is always, or almost always, present, and has been found far advanced in a case where death occurred in twenty-four hours. The phosphorus liver, except that as a rule it is enlarged and not diminished in size, resembles to the naked eye the liver of acute yellow atrophy. Fatty degeneration also may be present, of the muscular fibres of the heart, of the kidneys and of the epithelial cells of the intestinal mucous membrane. Spots of extravasation are often present under the serous and mucous membranes, and in other tissues. The skin may be yellow and the stomach contents phosphorescent. Signs of inflammation of the mucous membrane of the alimentary canal are not commonly present. In exceptional cases the *post mortem* appearances have been entirely negative. **Treatment.**—In acute cases, emetics may be given and vomiting promoted, or the stomach-pump used. No oil or fatty matter should be given, as these dissolve phosphorus. Turpentine, in 40-minim doses often repeated, is recommended as an antidote. **Detection.**—

Phosphorus readily undergoes oxidation in the body, hence after death analysis may fail to detect its presence. Solid yellow phosphorus is easily recognized by its physical character. If present in organic mixtures in considerable quantity, it may be separated as a sediment by washing, afterwards melting it, if finely divided, under warm water; or it may be extracted from organic matters by carbon disulphide, in which it is soluble. If present only in small quantity, one of three processes may be employed, viz. (1) Mitscherlich's. Acidulate the matters with H_2SO_4 and distil them to dryness in the dark, using a well-cooled glass condensing-tube, which will show luminosity of phosphorus to be present. (2) A modification of Marsh's process, by which phosphorus, if present, becomes converted into gaseous hydrogen phosphide (PH_3), which burns with an emerald-green flame, and produces a black precipitate in silver nitrate solution, the liquid, after removal of the excess of silver, showing the presence of free phosphoric acid. (3) Lipowitz's method. Acidulate the matters with H_2SO_4, and boil fragments of sulphur in them for an hour; remove and wash the fragments of sulphur, which, if phosphorus is present, will be found to have become luminous in the dark, owing to the deposition of phosphorus upon them. Phosphorus boiled with HNO_2 becomes converted into phosphoric acid, the presence of which may be recognized by precipitation with a mixture of ammonia, ammonium chloride, and magnesium sulphate solutions. In this way, also, its quantity may be estimated.

Chlorine, Bromine, and Iodine.

Chlorine, largely used as a disinfectant and in bleaching, is a highly irritant gas, causing great irritation and inflammation of the air-passages, and acting as an irritant also on the conjunctiva. Workmen in chlorine factories are, however, said to become in time to a certain extent habituated to its presence. The hypochlorites contained in bleaching-compounds, *e.g.* chlorine of lime and liquor sodæ chlorinatæ, also act as irritant poisons. Treatment.—Inhalation of diluted hydrogen sulphide; this, however, must be employed with caution, as hydrogen sulphide is in itself highly poisonous.

Bromine.—This in the liquid form is a corrosive poison. In the form of vapour its effects are similar to those produced by chlorine. One case of death in seven hours from an ounce of liquid bromine is recorded. Bromide of potassium in single doses has been known to give rise to symptoms of poisoning.

In large doses taken for a considerable time, it causes impairment of the functions of the brain and spinal cord, such as diminished activity of reflex action, cloudiness of intellect, impairment of memory and of articulation, and tendency to stupor.

Iodine.—Free iodine is a corrosive irritant; in poisoning by it the vomited matters are often blue or black owing to its action on starch. Twenty grains has caused death, but recovery is recorded from 1½ drachms. Iodine in small doses, often repeated, is liable to give rise to chronic poisoning, the chief symptoms of which are, irritability of the stomach, vomiting, and purging, accompanied by salivation and wasting of the body generally, and specially of the breasts or testicles. Iodide of potassium has frequently been given medicinally in comparatively large doses (100 grains or more a day) without producing ill effects. Sometimes, however, small doses, often repeated, give rise to symptoms resembling those of severe catarrh, and in exceptional cases such symptoms have even arisen from single small doses. In exceptional cases also the ordinary symptoms of catarrh have been accompanied by somewhat severe symptoms of irritant poisoning.

Sulphur dioxide, commonly called Sulphurous Acid. This gas, like nitrous acid, acts as an irritant to the air-passages. From Woodman and Tidy's experiments it appears that when the quantity is small, animals soon get accustomed to its presence, and thereafter do not suffer nearly so much from its irritant action.

Nitrous Acid.

The vapours of nitric acid and the red gas evolved during the oxidation of matters by nitric acid,[1] are highly poisonous, giving rise when inhaled to inflammation of the air-passages and lungs. A few cases of death from the inhalation of such vapours are on record. In some of these the fatal result has followed on exposure for a few minutes to the vapours arising from a quantity of nitric acid, accidentally spilled by the breaking of a large vessel filled therewith. In these cases a noticeable feature has been the slight amount of discomfort felt for the first two or three hours after the accident, death nevertheless occurring rapidly (within ten to fifteen hours).

[1] Nitrogen peroxide (NO_2) and nitrous anhydride (N_2O_3); the latter, by combination with water, yields nitrous acid (HNO_2).

Oxalic Acid.

Oxalic and **acetic** acids may be conveniently considered here:—

Poisoning by oxalic acid is rare in India, but tolerably frequent in Europe. In England, in the five years ending 1880, seventy-four deaths from oxalic acid were registered, of which sixty-five (about seven-eighths) were suicidal, and the rest accidental. I have met with but four fatal cases in Bombay in twenty years. Of these three were suicidal, and the fourth apparently homicidal. Many accidental cases owe their origin to the resemblance in appearance of oxalic acid to sulphate of magnesia. Homicidal cases (probably owing to the strongly acid taste of the poison) are rare. Oxalic acid and the acid alkaline oxalates are chiefly used in the arts for cleansing purposes, *e.g.* cleansing leather, wooden boards, etc., and removing ink stains and iron moulds from linen.

Symptoms.—Oxalic acid and the acid alkaline oxalates possess both a local and a remote action. Of these, the remote action is much the more serious, and is usually the cause of death. Local action.—This is corrosive or irritant in character according to the degree of concentration of the poison. Swallowed in concentrated solution, the symptoms due to the local action of the poison are immediate burning pain in the mouth and throat, with sense of constriction, followed rapidly by pain in the abdomen, and vomiting of matters containing altered blood. The interior of the mouth has a bleached white appearance; and if the patient lives long enough, purging sets in, the stools containing blood. Swallowed in dilute solution, the symptoms due to local action are those of non-corrosive irritant-poisoning. There is an acid taste, but no burning pain, in the mouth; and vomiting does not come on for fifteen or twenty minutes: in one case it did not come on for seven hours. Remote action.—The symptoms due to this are twitchings of the muscles, in some cases amounting to tetanic convulsions; numbness, tingling and cramp in the limbs; great depression of the heart's action: slow spasmodic respiration; collapse, and stupor or insensibility, and sometimes delirium. These symptoms may be unaccompanied, or almost unaccompanied, by vomiting, pain, and other symptoms of local action. After-symptoms.—In cases of recovery, loss of voice has been observed, in one case complete for eight days, in another partial for more than a month. Alteration of the voice is sometimes present in acute cases. Numbness and tingling of the limbs and twitchings of the muscles may remain for some time after the first effects of the poison have disappeared. So also may irritability of the stomach; and as in other cases

of corrosive poisoning, death may occur after a considerable interval, from starvation.

Fatal dose, about half an ounce; cases, however, are reported of death from one drachm (in a boy aged 16), and three drachms (in a female aged 28), death taking place in respectively twenty-one hours and one hour. Cases of recovery after swallowing an ounce or more are reported.

Fatal period.—Exceptionally short, usually under one hour. Death has occurred in three minutes, in ten minutes, and in one case, not until the fourteenth day, from starvation. Woodman and Tidy mention a case where a man is reported to have walked ten miles after swallowing an ounce of oxalic acid.

Post mortem signs.—These vary according to the degree of concentration of the poison and rapidity of death. If the poison has been swallowed in a tolerably concentrated form, the lining membrane of the mouth, throat, and gullet is found white, shrivelled, and easily detached. If death has been rapid, the mucous membrane of the stomach may be pale, but usually is deep red, in places black, and may be found eroded. Perforation is rare. The stomach has been found so soft as to tear easily. The intestines may be found inflamed, and the lungs are often congested. Congestion of the brain has been found; and in one case, probably from violent vomiting, apoplectic effusion was present.

Treatment.—Administration of saccharated solution of lime, or of chalk suspended in water. Magnesia or carbonate of magnesia may be given instead of chalk. After administration of antidotes, warm water may be given freely. Vomiting should be promoted. Alkalies are inadmissible, and the stomach-pump should not be used if much corrosion be present, and, if used, should be introduced with great caution.

Oxalates.—Two acid potassium oxalates are in common use in the arts, viz. the binoxalate and the quadroxalate. Both are sold under the names of "salt of sorrel," and "essential salt of lemons," and both are nearly as poisonous as oxalic acid. The binoxalate has caused death in eight minutes. Half an ounce of it has proved fatal, but recovery is recorded from one ounce. Several deaths have occurred by eating the stalks of rhubarb boiled. The symptoms, treatment, etc., are precisely the same as in poisoning by oxalic acid. Detection.—Alkaline oxalates are found in many plants, *e.g.* in wood sorrel, and in its Indian substitute Rumex vesicarius (*Chuka*); and also that oxalate of lime is found in many plants.[1] In cases, therefore, of alleged

[1] *E.g.* in rhubarb root and squills. *See* also Arums.

poisoning by oxalic acid or an oxalate, the *post mortem* appearances are, and the determination of the quantity of poison may be, of great importance. Oxalic acid is entirely dissipated by heat. In solution it yields: (1) With nitrate of silver a white precipitate insoluble in hot acetic acid, but slowly soluble in cold, and which, when collected, dried, and heated, is converted into metallic silver with a slight explosion. (2) A white precipitate with sulphur of lime solution, insoluble in acetic acid, which, when dried and heated, becomes converted into carbonate of lime without charring. From organic mixtures, oxalic acid and soluble oxalates may be separated by boiling with water, filtering, and precipitating the filtrate with acetate of lead; subsequently decomposing the oxalate of lead by suspending it in water, and subjecting it to the action of a current of hydrogen sulphide. Insoluble oxalates should be first decomposed by boiling with solution of caustic potash.

Acetic acid, tartaric acid, and citric acid.—Acetic acid acts as a corrosive if concentrated, but as an irritant when dilute; one fatal case is recorded in a girl, *æt.* nineteen, and another in a child aged two. Vinegar contains about 5 per cent. of this acid, and might possibly, in large doses, act as a poison. Acetic acid may be separated from organic mixtures by distillation and recognized (1) by the odour, and (2) by boiling with sulphuric acid and alcohol, when a peculiar aromatic smelling vapour (acetic ether is evolved). Tartaric acid and citric acid in large doses act as irritant poisons; one ounce of tartaric acid has caused the death of an adult, and one fatal case, also in an adult, from four or five tablespoonfuls of cream of tartar (potassium bitartrate) is on record. Citric acid is believed to be more poisonous than tartaric acid.

Salicylic Acid Poisoning.

A case of poisoning by salicylic acid was reported from Cooch Behar. The deceased, after taking his evening meal, vomited, had several loose stools and died. The *post mortem* examination revealed patches of congestion of the mucous membrane of the stomach, and the stomach was empty. The mucous membrane of the small intestines was highly congested and they contained bloody fluid. The large intestine was empty. There was enlargement of the spleen. The stomach and portions of liver and kidney were forwarded to this department for examination and salicylic acid was detected in them.—Ch. Bose, *Beng. Chem. Ex. Rept.*, 1910.

CHAPTER XXV.

METALLIC IRRITANTS.

Arsenic.

Arsenic is the favourite poison employed by murderers in India, as in Europe, just as opium is the favourite of suicides. It is fortunate for the ends of justice that it is so, as the most infinitesimal traces of this poison can be detected with such absolute certainty and ease that there is almost no possibility of its escaping detection, if suspicion be once aroused. But it frequently happens that when the amount administered is not sufficient to cause violent irritation, the murder passes undetected, and not until the administerer emboldened by success develops a lust of murder is suspicion aroused by the number of his or her victims.

Its comparative tastelessness, the minute quantity of the dose necessary to destroy life, the readiness with which it can be procured in any bazaar, and the resemblance of its symptoms to those of the natural endemic disease—cholera—all render it an easy and effective agent in the hands of the subtle poisoner.

In Europe, the Marchioness de Brinvilliers, who lived in the time of Louis XIV., studied the effects of arsenical poisoning by giving poisoned sweets to the poor in the hospitals. She afterwards poisoned her father and two brothers. Another woman at the beginning of the eighteenth century poisoned more than 600 persons, while a third in more modern times disposed of 15, including her three children, two husbands, and an intended third. Henrietta Robinson was convicted in 1888 of the murder of her son by arsenic, and when the bodies of eight other members of her family and servants were exhumed the same poison was found in all of them but two. Twenty-four cases of poison by means of fly-papers were recorded.

Homicidal poisoning by arsenic is declining to some extent owing to the restrictions imposed on the sale of poisons and the publicity in the newspapers of murder cases. Such publicity gives a person of criminal tendency a wholesale fear of detection and a sense of insecurity in the face of the growing science of toxicology.

It is less commonly used for suicide.

Action.—Arsenical compounds act (*a*) locally as irritants, and (*b*) remotely on the nervous system; hence in cases of arsenical poisoning there may be present: (1) Irritant symptoms; and (2) Nervous symptoms.

1. **Irritant symptoms.**—Arsenical compounds act as irritants to the mucous membrane of the stomach and intestines, exerting this action even when introduced into the system by channels other than the mouth, *e.g.* even when absorbed through a wound. They also exert an irritant action on the various emunctories.

Hence in cases of arsenical poisoning there may be present: (*a*) The usual symptoms of irritant poisoning (unaccompanied, however, by any metallic or acid taste in the mouth), namely, epigastric and abdominal pain, thirst, vomiting, tenesmus, purging, etc., and even perforation of stomach, with presence of blood in the vomit and stools; and (*b*) symptoms due to the irritant action of the poison on the skin, kidneys, liver, etc., such as conjunctivitis, painful cutaneous eruptions and desquamation of the cuticle, salivation, dysuria, suppression of urine leading to uræmic coma, and jaundice.

2. **Nervous symptoms.**—The symptoms resulting from the remote action of arsenical compounds on the nervous system vary greatly in different cases. Thus there may be: (*a*) Collapse, with coldness of the surface and feeble pulse; or (*b*) Numbness and tingling of the extremities, cramps, and even paralysis; or (*c*) Convulsions, choreic, epileptiform, or tetanic, and lock-jaw; or (*d*) Delirium, and acute mania; or (*e*) Headache, drowsiness, and stupor, deepening into coma; and irritant symptoms may be inconspicuous.

Types of Arsenical Poisoning.

Cases of arsenical poisoning fall into three types, namely, (1) *Irritant*, (2) *Narcotico-Irritant*, and (3) *Narcotic*. In the great majority of acute cases, well-marked and severe irritant symptoms are present. Such cases either (*a*) prove rapidly fatal—say within twenty-four hours—by collapse; or (*b*) the usual symptoms of irritant poisoning are followed by various nervous symptoms, the patient either recovering or dying in one or other of a variety of modes; from exhaustion, or by coma, or in tetanic convulsions. In some of these irritant cases, remissions, or even intermissions, of the irritant symptoms, have been observed. In a few acute cases, irritant symptoms may be absent (see *Case*, p. 486) or slight (*Cases*, p. 486 (1–5)),

and the *nervous symptoms* well marked (see *Cases*, p. 486 (1st para.)); such cases usually prove rapidly fatal either by collapse or by coma.

Case (*a*).—**Irritant arsenic poisoning—Large dose.**—The victim, a native Christian missionary of Calcutta, was believed to have been poisoned by his wife and her paramour. Deceased was seized with violent vomiting and purging and died in a few hours. The wife reported the death to have taken place from cholera, but the police, on suspicion, had the body examined, and the stomach, its contents, and portions of other viscera were forwarded for analysis. More than 42 grains of solid white arsenic were detected in the stomach alone. The woman and her paramour were tried at the High Court, but were let off, owing to insufficient evidence to connect them with the purchase and administration of the poison.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case (*b*).—**Slow arsenic poisoning—Maybrick case.**—Mr. Maybrick, a cotton broker of Liverpool, aged 49, married Florence, an American lady, aged 21. They had two children, but the marriage proved unhappy. Seven weeks before his death in 1889, Mrs. M. went to London and lived some days at a hotel as the wife of another man. About April 12–19th, 1889, Mrs. M. purchased arsenical fly-papers. On April 13-20th, Mr. Maybrick visited London and consulted Dr. Fuller for dyspepsia, who prescribed for him mild remedies, but no arsenic; in one bottle of medicine, ostensibly made according to Dr. Fuller's prescription, arsenic was subsequently found. Up to Saturday, 27th April, Mr. M. was in usual health, he then became sick, numbed, and in pain, and had cramps. About this date fly-papers were found by the servants soaking in Mrs. M.'s room, in a sponge-basin carefully covered up. On the 29th she again purchased two dozen fly-papers from another druggist. On 1st and 2nd May, Mr. M. went to his office and had his lunch sent to him by Mrs. M., and in one of the jugs, found at the office after his death, arsenic was found. On the evening of the 3rd May he was seen by Dr. Humphreys and complained of being sick from his revelenta food, and had persistent vomiting and coughing and tingling in throat on the 4th and 5th. The vomiting lessened on the 6th, and Fowler's solution was ordered, but only a quantity equal to $\frac{1}{300}$ grain was actually taken. On May 7th the throat was red, dry and glazed, and diarrhœa commenced, and the result of a consultation was that Mr. M. must have taken some irritant in his food or drink. On 8th and 9th severe tenesmus setting in with bloody diarrhœa, Dr. Humphreys suspected arsenic and examined the urine and made a rough analysis of some Neave's food the patient had been taking. The patient died on the 10th. The *post mortem* showed signs of irritant poisoning, and an ulcer of epiglottis (caused by the lodging of a speck of arsenic); but no arsenic was found in the stomach or its contents or in the spleen. Arsenic was found in the liver, intestines and in the kidneys. The quantity separated amounted to over 0·1 grain. The liver weighed 48 ozs., and from 12 ozs. of the liver 0·076 grain of arsenic reckoned as As_2O_3 was separated. Facts connecting Mrs. Maybrick with the death were :—On the night of either May 9th or 10th she was observed to remove from the table an opened bottle of meat juice and take it to an inner room and then replace it surreptitiously. In replacing it she was observed to take it from the pocket of an inner jacket. The lining of this pocket was found to be impregnated with As_2O_3, and the juice contained 0·5 grain As_2O_3. The following things contained arsenic :—Mrs. M.'s dressing gown, her apron, and handkerchief wrapped round a bottle, a portion of a handkerchief,

Price's glycerine, medicine purporting to be that prescribed by Dr. Fuller, three bottles of saturated solution of arsenious acid, lavatory drain. Mrs. Maybrick was convicted and sentence commuted to penal servitude for life.—T. Stevenson, M.D., *Guy's Hosp. Rept.*, 1889.

Case (*c*).—**Narcotic and nervous symptoms.**—(1) A child was reported to have had vomiting in half an hour after eating some jaggery. It died soon after, evidently in a convulsion, for it is reported that "the eyes rolled upwards and the lips and tongue became blackened." Over thirty-two grains of white arsenic were found in the stomach.—*Mad. Chem. Ex. Rept.*, 1898. (2) In a suicidal case, suspected to be opium poisoning on account of the narcotic symptoms, arsenic was found in very large quantity and no trace of opium. The man died in about eight hours without vomiting or purging. The pupils were contracted to pin points.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 9. (3) A convict compounder in Port Blair in 1906 was found unconscious and groaning and having violent spasms. There was no vomiting or purging, and he died in a few hours. The *post mortem* showed punctiform hæmorrhages in stomach and small intestines; the large intestine was normal and contained semi-solid fæces. Arsenic was found.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Case (*d*).—**Absence of symptoms.**—Orfila I., *Obs.* IV., 314, relates a case of a woman aged 27 who expired in about 12 hours from a large dose of arsenious acid, without any sign of pain or vomiting and but little thirst, although the usual *post mortem* signs were found.

Case (*e*).—**Accidental—Large dose—Absence of vomiting.**—In September, 1901, a Mussulman male, aged 18, was brought to the Calcutta College Hospital. His friends state that about 2 P.M. after a meal he took in mistake for chalk a *tola* or about half-ounce of white arsenic. He became very ill some time later and was admitted at 4 P.M. conscious. Extreme restlessness. Patient is crying out that his stomach is burning, and his agony is evidently great. Saliva pouring from the mouth. Bowels moved two or three times after admission; but there was no vomiting even after an emetic. Stomach washed out. The washings contained small lumps of white arsenic. He became rapidly unconscious 20 minutes after admission, and died 4½ hours after taking the poison.—C. Robertson-Milne, *Ind. Med. Gaz.*, 1902, p. 209.

Case (*f*).—**Irritant symptoms slight.**—Of 305 fatal cases reported to the Bombay Chemical Analyser's Office during the ten years ending 1884 six (and as only meagre reports were furnished with many cases, possibly others also) were cases of this form. In four of the six the duration of the case was stated, and in all four deaths occurred within fourteen hours. In two of the six, there was no redness of the mucous membrane of the stomach. In one of these (1), a female, who vomited once only, and had no purging, there was also no redness of the mucous membrane of the intestines. In the other (2), a man, who had vomiting, but no purging, there was one patch of redness about the middle of the rectum. *Post mortem* appearances of irritation were well marked in the other four cases. The symptoms reported in these were respectively: (3) heat in the abdomen and thirst, slight vomiting and purging before admission into hospital, none after. (4) Had vomited and purged four times before admission into hospital. While in hospital was drowsy, vomited once only, and had no purging. Conjunctivæ eight hours after admission noticed to be tremendously injected. (5) Had fever and severe pain in the abdomen, no vomiting, and no purging. (6) Great thirst, restlessness, picking at the bed-clothes, and incoherence, no vomiting and no purging. Cases

(4) and (5), although under medical observation, were not, during life, recognized as cases of poisoning. In case (4) only one and a half grains of arsenious oxide was found in the contents of the stomach. In case (6) the quantity found was one hundred grains. In the other four cases, the quantity found ranged from nine to fifteen grains. K. M. (*Beng. M. R.* for 1868-69) mentions a case where a girl, *æt.* seven, died in three hours, neither vomiting nor purging being present. Similar cases are recorded by various authors. Christison (*Poisons*, pp. 308 *et seq.*, 1845) gives fourteen cases, all fatal within twelve hours, in which only slight irritant symptoms were present. In five of the fourteen, *post mortem* appearances of irritation were either altogether absent or trifling only.

In chronic cases both irritant and nervous symptoms are usually present. Sometimes in chronic cases the amount of gastric irritation is slight, while the irritant action of the poison on the skin, causing skin eruptions with pigmentation, bronchitis, etc., bronchial tubes and emunctories other than the intestines, is well marked. In chronic cases, the nervous symptoms frequently take the form of numbness and tingling of the extremities, and paralysis: peripheral neuritis. This last effect has occurred in epidemic form amongst beer drinkers through contamination of arsenic in the beer. These cases show that arsenic is culminative. The sequence of symptoms in chronic poisoning is (1) digestive, (2) laryngeal catarrh, bronchitis and skin affections, (3) disturbance of sensibility, (4) motor paralysis with pigmentation and keratosis.

Diagnosis from disease.—Acute irritant cases with collapse greatly resemble cholera, and may be mistaken for it by medical men well acquainted with cholera, see *Case*, p. 488, and in India a common way of attempting to conceal homicidal poisoning by arsenic is to report the case as one of death from this disease. Sometimes also, especially in cases where two or more persons after partaking of food in company are attacked by cholera in quick succession, a groundless suspicion of arsenical poisoning arises. The chief points which distinguish arsenical poisoning *from cholera* are: (1) The presence in the former of blood in the stools; (2) The absence in the former of the rice-water appearance of the stools, characteristic of cholera (this appearance may, however, be present in the later stages of arsenical poisoning); and (3) In cholera, pain in the throat does not precede vomiting; while in irritant poisoning the reverse is the case. The prevalence or absence of cholera in the locality at the time may also serve as an aid to the diagnosis. Cases where the irritant symptoms are slight are sometimes not recognized during life as cases of poisoning.

In chronic cases persistent gastric irritation not yielding to treatment, accompanied by numbness and tingling of the

extremities, with tendency to paralysis, should arouse suspicion, and indicate the necessity of subjecting the urine or other evacuations to analysis. It may be mistaken for Addison's disease and beriberi.

Cases.— **Arsenic poisoning mistaken for cholera.** — (1) In 1899 a Mohammedan woman, aged 26, died after violent purging and vomiting which was reported as cholera by her husband's relatives. The brother of the deceased, however, suspected foul play and informed the police, who caused a *post mortem* examination to be made. The stomach and intestines were reported by the Assistant-surgeon to be "healthy, the former containing some fluid of a rice-water colour," and he attributed the cause of death to cholera, but forwarded the viscera for chemical examination as the case was suspicious. Arsenic was detected in the viscera, also in the stains of vomited matter on the clothes of the woman and in the earth taken from the spot on which she had vomited. The police then arrested the husband of the deceased on suspicion and had the house searched. A glass phial was found, in which a large quantity of white arsenic, in powder, was detected, mixed with sugar and rose-water, which were probably added to mask the supposed acrid taste of white arsenic. (2) Two other fatal cases of arsenic poisoning alleged to be cholera occurred in 1899 in Backergunge:—The civil surgeon in forwarding the viscera of two Mohammedan women, aged 40 and 20, stated that the police report:— "The two deceased vomited, purged and expired. It is suspected that some sort of poison had been administered with the food." As his *post mortem* examination detected nothing abnormal in the stomach and intestines, which were found to be "healthy and containing digested food," he ascribed the two deaths to cholera. On chemical examination very marked quantities of arsenic were detected in the viscera in both cases, and arsenic was also found on the clothes and beddings stated to have been soiled with the vomit and purging of the two deceased. These three cases are of medico-legal interest, firstly, from the close resemblance of the symptoms to cholera, with which disease homicidal arsenic poisoning cases have been mistaken even by experienced medical men; and secondly, in the entire absence of irritant signs in the alimentary canal. L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899. (3) A woman died in Jessore in 1906 with vomiting and purging which was reported as cholera, but the police on certain information sent the viscera for examination, and arsenic was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Interval between swallowing the poison and first appearance of symptoms.—This is usually half an hour to an hour. Cases, however, have been reported where the symptoms appeared almost immediately. Taylor[1] mentions a case where the symptoms came on while a man was in the act of eating a cake containing the poison. I once met with a case where the symptoms appeared while a man was drinking a cup of tea made with water from a kettle into which arsenious oxide had been introduced. On the other hand, a few cases are reported in which this interval has been delayed to two, to eight or nine hours. In some of these cases the prolongation of the interval is difficult to account for; in others it appears

[1] Taylor, *Poisons*, p. 292.

to have been due to fulness of the stomach, to sleep, or to intoxication (see *Cases* below), and occasionally there are almost no symptoms (p. 486).

Cases.—**Arsenical poisoning; delayed symptoms.**—(*a*) (Christison on *Poisons*, p. 299). A man took seven drachms of arsenious oxide at eight in the evening, went to bed at half-past nine, and slept till eleven, when he awoke with slight pain in the stomach, vomiting, and cold sweats—he died in nine hours.—(*b*) (*Beng. M. R.* for 1870-72). Five persons, members of the same family, were poisoned by sweetmeat containing arsenious oxide; one of the five, a child, *æt.* four, was roused from sleep to partake of the sweetmeat and fell asleep again afterwards; in her case, the symptoms did not appear for two and a half hours, while in the other four—all adults—the symptoms appeared in about an hour. Two of the adults had not supped previous to eating the sweetmeat—both these died. The other three individuals had just finished their evening meal, and all three recovered.—(*c*) (Woodman and Tidy, *For. Med.*, p. 163). A female took ½ oz. of arsenious oxide after a meal. No symptoms appeared for eight hours, when pain, vomiting, and purging set in; the stomach-pump was used. Result, recovery.—(*d*) (Christison on *Poisons*, p. 308, one of the fourteen cases referred to under 9). "The subject was a man so addicted to drinking, that his daily allowance was a pint of brandy. When first seen, there was so much tranquillity, that doubts were entertained whether arsenic had really been swallowed, but at length he was discovered actually chewing it. This state continued for nearly five hours, when some vomiting ensued. Coldness of the extremities and spasmodic flexion of the legs soon followed; and in a few minutes more he expired."—(*e*) (*Ib.*, p. 309). A man swallowed three drachms of arsenious oxide, then went about for two hours, bidding adieu to his friends; he was then persuaded to take emetics, which caused free and easy vomiting; he hardly suffered at all for five hours, but died nine hours after taking the poison.

Fatal period.—In acute cases this is usually under twenty-four hours. In many cases, especially those in which marked nervous symptoms appear early, death takes place in under twelve to fourteen hours. In one case a young man died with tetanic symptoms in twenty minutes;[1] this is the shortest fatal period recorded. Longer fatal periods than three days are sometimes met with. Taylor[2] mentions cases of death in six days, seven days, fifteen days, and sixteen days. In one case (a woman accidentally poisoned by external application of a solution of arsenic), death did not occur for two years.

Post mortem signs.—Gastric mucous membrane is usually reddened from inflammatory action, and has been found so even where the poison has been introduced by channels other than the mouth. It has been found intensely inflamed even when death has taken place within two hours after swallowing the poison. It may be reddened in patches, or

[1] Taylor, *Poisons*, p. 308. [2] *Ibid.*, pp. 27, 309.

the redness or hæmorrhages may be punctiform or striated in appearance, or the whole mucous membrane may be deep red, with dark petechi or ecchymosed spots from underlying extravasated blood. Frequently the inner surface of the stomach has a corrugated appearance, and is covered with tenacious mucus entangling particles of the poison, if the latter was given in solid form. Its contents are often dark in colour from altered blood. When arsenic is given as a powder, sometimes minute specks or patches of whitish or yellow powder (due to conversion of the white arsenic into yellow sulphide) are formed embedded on the surface of the mucous membrane of the stomach or intestines, and each speck may be the centre of inflammatory patch. The redness and patches sometimes extend into the duodenum; more rarely the intestines are found inflamed throughout their whole length. Commonly the rectum is found inflamed. Ulceration of the gastric mucous membrane is not common, but has been found in case of death in ten hours. Perforation of the stomach is very rare, but is occasionally found (see *Case* below). Sometimes in fatal cases the stomach and intestines show little or no signs of inflammatory action; this has been observed even in a case where well-marked irritant symptoms were present during life. Hæmorrhage beneath the endocardium, especially of the left ventricle, in the form of dotted petechiæ or in larger patches is extremely characteristic, and has been found by Gibbons and Powell in forty-three of sixty cases of acute poisoning. *This is a very valuable sign.*

Out of thirty-three cases in which the condition of the heart[1] was noted, in eight only was the endocardium found natural. Congestion of the brain, lung, kidneys, or liver is sometimes met with.

Arsenic exerts a marked antiseptic action on the tissues, and hence, in fatal cases, *post mortem* appearances of gastric irritation may remain recognizable for a considerable period. *Post mortem* appearances indicative of death from arsenical poisoning have been found coupled with *post mortem* appearances pointing to death from mechanical violence (see *Case,* p. 215); hanging (see *Case,* p. 216); and even in bodies found under circumstances which pointed to death by drowning.

Cases.—**Perforation of the stomach** in arsenical poisoning.—This was reported in two of the three hundred and five Bombay fatal cases. In a case reported by Dr. R. H. Batty; in this case a woman, *æt.* about

[1] *Medico-legal Rept.*, 1870–72, p. 255.

thirty-five, after a quarrel with her husband, swallowed a quantity of arsenious oxide. Duration of case not stated. *Post mortem* appearances; much congestion of the membranes of the brain, also of the brain, lungs, kidneys, and liver. Heart normal. Œsophagus pale. Mucous membrane of stomach intensely red, with white particles adhering to it. Stomach perforated in three places on the posterior wall; two of the perforations very minute, the third "about the size of an ordinary quill"; from the latter, a long ropy mucous substance was protruding, in which there was a large quantity of minute white particles of arsenious oxide. Small intestines very red throughout, and containing particles of solid arsenious oxide.

Case.—**Arsenical poisoning with absence of inflammation** in the stomach and intestines.—Christison, besides the five cases mentioned, gives two other cases in which, on *post mortem* examination, the mucous membrane of the stomach and intestines was found to be free from signs of inflammation (*I.B.L.*), and I have met with one other case (out of three hundred and five), in which only trifling signs of inflammatory action were present. Harvey (*Beng. M. R.* for 1870–72) records absence of signs of inflammation in four cases out of one hundred and ninety-one. In one of these cases, the symptoms were "vomiting, purging, dryness of the mouth, thirst, anxiety, vertigo, and prostration." Death occurred in nine hours. In this case, the "whole of the intestinal tract" was found healthy.

Treatment.—(*a*) Elimination. This should be chiefly relied on. Vomiting should be encouraged, and copious draughts of warm water given, or better emetics, or the stomach-pump. Arsenic is rapidly voided by the urine. (*b*) Prevention of action by antidote. Hydrated ferric oxide should be given in considerable quantity. Thirty-two parts by weight of this antidote are required to render insoluble one part by weight of arsenic oxide. The antidote must be freshly prepared, as it loses its power if kept for any length of time. To prepare it, a quantity of a solution of a ferric salt, *e.g.* ferric chloride, should be either rubbed up in a mortar with magnesia, or precipitated by solution of ammonia; in the latter case the precipitate must be washed on a calico filter before administration. (*c*) Counteraction of effects. This indication must be carried out on general principles. Demulcents should be given to allay irritation, and other symptoms treated as they arise.

Fatal dose.—The smallest fatal dose for an adult hitherto recorded is under two grains of Arsenious Oxide. It was the case of a woman who took half an ounce of Fowler's Solution (Arsenite of Potassium) during a period of five days in unknown doses, and she died by syncope without vomiting or purging, but the stomach and intestines were inflamed (Castle, *Prov. Jour.*, 1848, 347). In another case two and a half grains of Arsenious Oxide contained in two ounces of 'fly-paper' killed a robust healthy girl, aged nineteen, in thirty-six hours (Taylor, II., 482).

Hence under circumstances favourable to the action of the poison, the fatal dose for an adult may be estimated at two to three grains of arsenious oxide. Cases of recovery under free vomiting are recorded from doses of one to two ounces of arsenious oxide. In one very exceptional case of recovery from a large dose (*Case* below) the poison swallowed—two masses of arsenious oxide, weighing together 105 grains—was passed per anum. Persons in the habit of taking small doses of arsenic daily may gradually increase the quantity until able to swallow as much as four to six grains of arsenious oxide without experiencing symptoms of poisoning. This habit of 'arsenic eating' is practised by the peasants of Styria under the belief that it improves the skin and increases the respiratory powers; the same habit prevails to a certain extent in the Panjab, arsenic being there eaten either as an alternative to opium eating, or as an aphrodisiac.[1]

Case.—**Arsenical poisoning**—Exceptional recovery.—A Parsee, admitted into the Jamsetjee Jeejeebhoy Hospital, Bombay, had swallowed two masses of arsenious oxide. Sixteen hours afterwards, he passed, per rectum, a mass of arsenious oxide weighing eighty grains, and about forty-five hours after swallowing the poison he, in the same way, passed a smaller mass weighing twenty-five grains. The symptoms present were comparatively slight: there was no vomiting, but some diarrhœa; he was drowsy, his eyes were suffused, and he complained of headache and pain in the abdomen. He left the hospital quite well.—*Ind. Med. Gaz.*, 1872, p. 183.

Forms of Arsenic used as poisons in India.

These may be: (1) White Arsenic or Arsenious Oxide, (2) Arsenite of Potassium or Sodium, (3) Copper compounds—pigments, (4) Arsenic Acid, (5) Sulphides, (6) Chlorides, (7) Arsenuretted Hydrogen, (8) Cacodylates of Arsenic as anti-syphilide remedies.

In the great majority of cases arsenious oxide is employed; in a few the sulphides (orpiment and realgar) are used, either alone, or mixed with arsenious oxide, and exceptionally the arsenites of copper.

ARSENIOUS OXIDE.

Common white arsenic is known in the vernacular as *Sankhya,*[1] *Phatkya somul, or Somul khar.* This is yearly imported in large quantity, chiefly from the Persian Gulf, and

[1] *Med. Jur.*, p. 117. Or the 'conch shell,' from the vitreous lustre of the lumps of crude arsenic.

is readily purchasable all over India. The chief legitimate uses to which it is put in India appear to be as follows:—

(1) As a preservative agent, especially for wood. Chevers mentions that with this object it is thrown into the holds of vessels, and placed round wooden foundation piles, and applied to the woodwork and walls of houses. (2) In preserving and preparing the thicker kinds of skins for leather, and to a certain extent for preserving skins generally. (3) By goldsmiths in gold-working. (4) For the purpose of destroying rats and other vermin. (5) Medicinally, internally as a cure for fevers, syphilis, and other diseases; and externally as a parasiticide and depilatory, especially among prostitutes; and as a healing ointment for sores in horses and cattle. It has already been mentioned that it is used to a certain extent in the Panjab, as an alternative to opium eating, and as an aphrodisiac.

Homicidal use.—Of all poisons arsenious oxide is the one by far the most frequently employed in India for homicidal purposes. When so employed, the vehicle is most commonly sweetmeat or bread or other food.

Sweetmeat, poisoned with arsenic, often consists of but little more than sugar or '*gur*' (coarse sugar), and coarsely pounded arsenious oxide. Often a club or stick and a piece of flat board, or a couple of stones, are used for pounding the arsenic, and particles of the poison are found adhering to them. When bread is the vehicle used, the coarsely pounded arsenious oxide is often simply placed between two layers of or mixed with the dough. Sometimes, however, it is ground up with the flour, and the grindstones are found to have particles of the poison adhering to them. In some cases it is the person grinding the flour who adds the poison to it; in others, the poison is put into the handmill by another during the temporary absence of the person using it. Sometimes the vehicle is cooked vegetable food, *e.g.* cooked rice, pulse, etc.; also, in cases of alleged poisoning, arsenious oxide is found in sweet oil, in tamarinds, in *chuna* (lime) used with betel nut for chewing, and in one case it was found mixed with realgar in a '*biri*' or native cigarette.

Very often the quantity of the poison added to the food in a homicidal case is very great (see *Cases*, pp. 495-6), much more than enough to kill several persons, and the particles of arsenious oxide large enough to be clearly visible and weighing several grains (*Case*, p. 515). Arsenious oxide, when used for homicidal purposes, is generally used alone. It is, however, found sometimes in food with the sulphides of arsenic, with sulphate of copper, with mercuric sulphide, with sulphate of iron, and with pounded glass; and in the Baroda case (p. 496) it was found mixed with diamond dust. Frequently in one and the same case several persons are poisoned.

This was so in 98 out of the 507 cases of arsenical poisoning reported to the Bombay Chemical Analyser, during the ten years ending 1884.[1] Some of these 98 cases of multiple poisoning appear to have been, however, the result of accident. In multiple homicidal cases, very frequently some of the victims are children. In one exceptional year (1878–79), out of thirty-eight persons reported to the Bombay Analyser's Office, as having died from arsenic poisoning during the year, twelve were children.

The motives in India most commonly leading to homicidal poisoning by arsenious oxide appear to be revenge and sexual passion.

Common types of the crime are (1) A, at enmity with B, gives him (see *Case* below) or his children (see *Cases*, p. 495) some poisoned sweetmeat, or introduces arsenious oxide into his food; of which often others as well as B partake. As a result a number of persons, often the members of one family, children as well as adults, are poisoned (see *Cases* (*d*) and (*e*), p. 495); or (2) a wife, being anxious to get rid of her husband, puts arsenious oxide—often supplied by a paramour—into her husband's food. In some cases where husbands are poisoned by their wives, the motive is not homicidal, but connected with the belief in the *aphrodisiac* virtues of arsenic before referred to. Thus in a case where a woman confessed to having put a white powder (afterwards found to be arsenious oxide) into her husband's food, she alleged that the powder was given to her as a charm, or medicine, 'to increase her husband's love for her.' In *Case* (*a*), p. 496, this belief also may have led to the administration of the poison. *Case* (*b*), p. 496, is a curious example of a poison, prepared for a particular individual, going astray and poisoning others. It is seldom that in India acquisition of money or property forms the motive for arsenical poisoning. When *theft* is the object, datura (which see) is the poison usually employed. One or two cases of road robbery in which arsenious oxide was the poison used have, however, been reported. In exceptional cases also superstition leads more or less directly to arsenical poisoning (see *Case* (*c*), p. 497).

It should be borne in mind that the ease with which arsenious oxide can be obtained in India, and the difficulty of tracing its purchase, tends not only to increase the frequency of its use for homicidal purposes, but also to facilitate the fabrication of false charges of attempted poisoning by surreptitious introduction of arsenic into exhibits. Again also, it must be recollected that an individual, while in custody,

[1] *Beng. Medico-legal Rept.* for 1870–2 states that of 203 cases of poisoning by arsenious acid occurring in Bengal, N.-W. Provinces, Oudh and the Punjab during the three years, fourteen were cases of multiple poisoning; and of ninety-seven cases of arsenical poisoning reported to the Chemical Analyser, Madras, in the two years 1882–3, twenty-six were multiple cases.

may from fear make a false confession of poisoning. In *Case*, p. 497, there is little doubt but that such a false confession was made.

Cases.—**Arsenical poisoning—large quantity.**—(*a*) (*Bo. Chem. Analyser's Rept.*, 1872–73). In a case tried before the High Court, Bombay, it was proved that a man went up to another, a police sepoy, while standing on duty in the public streets, and offered him some sweetmeat. He took it, bit off a mouthful, but finding it to have a gritty taste, spat it out. From eight hundred and sixty grains of the remainder, I extracted six hundred and ten grains of arsenious oxide. The police sepoy, it was stated, had run away with the wife of the man who attempted to poison him.—(*b*) (*Rept.*, 1874–75). In a case from Ahmednagar, in which a man died in twelve hours after eating some poisoned bread, $5\frac{1}{2}$ lbs. of the bread were found to contain one thousand five hundred and fifteen grains of arsenious oxide.—(*c*) (*Rept.*, 1878–79). A woman was seen feeding two children, *æt.* respectively four and six, with sweetmeat; both children died. The stomach of the elder child contained one hundred grains of arsenious oxide, and arsenious oxide was found in relatively large quantity in an unconsumed portion of the sweetmeat The motive in this case was stated to be a quarrel with the parents of the children. —(*d*) (*Rept.*, 1882–83). Five persons, two adults and three children, inmates of a leper hospital in Bombay, were poisoned by sweetmeat containing arsenious oxide to the extent of about twelve grains per ounce. A large quantity of tamarinds was given at the same time to the same persons. The tamarinds contained about fifty grains per lb. of arsenious oxide. Some of the fragments of arsenious oxide contained in the tamarinds were as large as small beans. The motive in this case, it was stated, was to get rid of a leper husband, whose wife the accused wanted to marry.

Cases.—**Arsenical poisoning—Homicidal multiple cases.**—(*Bo. Chem. Analyser's Rept.*, 1880–81).—(*a*) In a case from Uran, a man and his wife and two children were all four poisoned by arsenious oxide contained in bread, given to them, it was alleged, by a neighbour who had a quarrel with the family. Two of the four died.—(*b*) In a case from Hyderabad (Sind), three children were poisoned by sweetmeat containing arsenic, given to them, it was alleged, by a man at enmity with their parents. One of the three, a baby, appears to have been poisoned by sucking the fingers of the other children.—(*c*) In a case from Ahmednagar, four persons, one of whom died, were poisoned by arsenious oxide contained in food. In this case the accused was, it was said, on bad terms with the persons poisoned, and was seen seated near some cooking-pots in which their food was being prepared, leaving just as they were about to commence their meal.—(*d*) (*Rept.* for 1879–80). In a case also from Ahmednagar, two children, both of whom died, and three adults were poisoned. In this case it was alleged that the aunt of the children was the poisoner. She was seen, whilst the food was being cooked, of which the persons poisoned afterwards partook, to throw something into the pot containing it, and was known to have recently purchased arsenic.—(*e*) (*ib.*) In a case from Hubli, it was reported that a man took some flour from a woman who was grinding it, afterwards throwing it back on to the handmill she was using. The woman having cooked the flour, she and her family partook of it: all were attacked with symptoms of irritant poisoning; all, however, recovered.—(*f*) (*Rept.*, 1881–82). In a case from Kaira, a man, it was alleged, gave some sweetmeat to another, with a request that he would give some of it to others that he named, saying that it was a '*prasad*'

(offering) of a goddess. The man to whom the sweetmeat was given, retaining some for himself, distributed the rest to the persons named, and these again gave some of it to three other persons. All who partook of the sweetmeat suffered from the usual symptoms of irritant poisoning; two died, one on the third, the other on the sixth day.—(*g*) (*Rept.*, 1879-80). At a mosque in Bombay, two Sayads were accosted by a man, afterwards arrested, who handed to them some food of which they partook; both were shortly afterwards attacked with symptoms of irritant poisoning. One of the two died; arsenious oxide was found in his viscera, and in the food which had been given to the two men. The individual arrested proved to be an imbecile, and apparently had no motive for injuring the persons poisoned. His story, which was very likely true, was that he was accosted by a man whom he did not know, and asked to take some food to the two Sayads.

Case.—**The Baroda Case.**—In this case "Colonel Phayre, the Resident at Baroda, experienced one morning a feeling of nausea, accompanied by salivation, and a peculiar taste, which he described as metallic; these symptoms came on about half an hour after he had swallowed a small quantity of sherbet, made of pumalo juice. Hastily concluding that the sherbet was bad, and had been the cause of the symptoms, he threw it away; but in the act of replacing the tumbler on the table, he noticed a sediment lying at the bottom of it. This sediment was proved, on analysis, to consist of arsenious oxide, mixed with finely powdered diamond."—Dr. Wellington Gray, *Bo. Chem. Analyser's Rept.*, 1874-75. It was alleged that this attempt to poison Colonel Phayre was instigated by the then Gaikwar of Baroda, and a Court of Inquiry was held. One of the Residency peons was suspected of having introduced the poison into Colonel Phayre's sherbet. On searching this man, a packet of arsenious oxide was found in his belt, and a sore was found on his skin, in such a situation as to make it possible that it had resulted from continued contact with the arsenic.

Cases.—**Arsenical poisoning; exceptional cases.**—(*a*) (*Bo. Chem. Analyser's Rept.* for 1884). In a case tried before the High Court, Bombay, four men were charged with the murder of a young dancing girl. The evidence went to show that one of the accused was deeply in love with the girl, who, however, had rejected his addresses. On this the lover called in the assistance of the other accused persons, and asked them to prepare—at least, so it was urged for the defence—a love-philtre, to be given to the girl, which would cause her to look favourably on his suit. The result was that a number of sweetmeat balls were prepared and distributed, with some ceremony, at an assembly where deceased and others were present. Apparently one of these sweetmeat balls contained poison, viz. the one given to the deceased, as she and her brother, to whom she had given a portion of the ball handed to her, were the only persons who suffered from symptoms of irritant poisoning. After death twenty grains of arsenious oxide were found in the contents of deceased's stomach. On the whole the evidence in this case was not inconsistent with the view that the theory set up by the defence was true, and that there was no murderous intent.—(*b*) (*ib.* for 1878-79). The history of a case from Gadag, in which four persons—two children, who died, and two adults, who recovered—were poisoned by arsenious oxide, was thus given by the assistant-surgeon in charge of the dispensary:—"The mother of the deceased children obtained three small sweetmeat balls from one of her paramours, with the object of administering the same to a man named Dushrath Sonar, who was also in love with her. The man who prepared the balls, and gave them to the woman, states

that he mixed some kind of white powder with the balls. The powder was procured by him from a mendicant Byragi (Hindu ascetic), and the sweetmeat balls were made especially mixed with the powder to poison Dushrath Sonar; but the woman, instead of giving them to the Sonar to eat, kept them in her house. During the absence of the woman from her house on some business, her mother happened to find the sweetmeat balls, and, not knowing that they were poisoned, gave two of them to the children to eat; the third ball was eaten by herself and her other daughter, who was in the house."—(*c*) (*ib.* for 1876–77). The history accompanying a case from Amraoti was as follows :—" A man lost some ornaments, and suspected his sister of stealing them. Under the advice of a ' wise man,' he put outside his door a copper pot, with a lump of cowdung in it, advertising his friends that he had done so, and that if the thief put the ornaments into the pot, nothing further would be said. This failed. The ' wise man ' thereupon assembled the neighbours, and an ordeal was instituted, each person being required to eat a small quantity of sugar." The result was that the sister died with symptoms of irritant poisoning, and one and a half grains of asenious oxide were found in the contents of her stomach.

Case.—**Apparently false confession of arsenical poisoning.**—In a case from Nasik a man died suddenly, and his brother accused deceased's wife of poisoning him. The wife was taken into custody, the body disinterred and examined: no signs of irritant poisoning were found. The viscera were forwarded for analysis. In the meantime the wife, while in custody of the police, confessed to having put arsenic into her husband's food and some white substance, stated to have been produced by her, was, on examination, found to be arsenious oxide. On analysis, however, not the slightest trace of arsenic could be found in the viscera of the deceased.—*Bo. Chem. Analyser's Rept.*, 1884.

Case.—**Arsenical poisoning.—Homicidal.—Large quantity** of poison found (Brown and Stewart, *Trials for murder by Poison*, p. 358).—(*a*) Dr. Christison, the great toxicologist, writing to the *Edinburgh Medical Journal*, December, 1857, cited a case undoubtedly one of murder, where between 90 and 100 grains of arsenious oxide were found in the contents of the stomach of an adult. The poison was administered in whisky punch, with sugar, the arsenic being kept in suspension by constant stirring. Professor Christison's letter had reference to an argument put forward for the defence in the **Madeline Smith case** (Edinburgh, 1857), namely, that as eighty-eight grains of arsenious oxide were found in the contents of the stomach of the deceased, and some of it in hard gritty crystalline particles, and there had been vomiting and purging, the case must have been one of suicide, but the quantity found amounted to no more than half a teaspoonful, an amount which could be readily administered with solid food in some thick liquid. Another argument of the defence was that the arsenic purchased by Madeline was mixed with soot, while no soot was found in the stomach or intestine of the deceased —her quondam lover,—and a girl was unlikely to know how to remove the soot from the arsenic—verdict was ' not proven.' (*b*) and (*c*) Taylor (on *Poisons*, p. 157) mentions two other cases, both charges of homicide, in which, after death, the quantity of arsenious oxide found in the stomach was large, viz. *Reg.* v. *Dodds*, in which 150 grains were found, and *Reg.* v. *Hewett*, in which 154 grains were found.

Case.—**The Agra Case.**—Clark, an officer of the Subordinate Medical Department, was charged in 1912 with the murder of Mr. Fulham, whose medical attendant he was and with whose wife he had an intrigue.

Poisoning was suspected and evidence given that the prisoner had large quantities of *Gelsemium*. Chemical examination failed to detect any alkaloid, but traces of arsenic were found in the thigh bone. The accused was found guilty and suffered the death penalty.

Abortifacient use.—Arsenious oxide is sometimes given or taken with the object of causing abortion, usually with fatal results.[1]

In one case, in Bombay in 1883, *post mortem* examination of a female four months advanced in pregnancy, disclosed a mass of paste containing arsenious oxide, lying in the upper part of the vagina near the os uteri.

Suicidal use.—Suicides by poison in India usually select opium; but a certain number use arsenious oxide. It would appear that in Bengal, N.-W. Provinces, Panjab, and Oudh, about one-third of the fatal cases of arsenical poisoning are suicidal, but that for one suicide by arsenic there are rather more than seventeen suicides by opium.[2] In Bombay also, about one-third of the fatal cases of arsenical poisoning reported to the chemical analyser's office appear to be suicidal; and these suicidal cases about equal one-tenth of the total number of suicides by poison shown in the mortality returns for the whole presidency. Sometimes, in suicidal cases, the quantity of arsenious oxide found after death in the contents of the stomach is very large.

Taylor[3] refers to a case where the quantity found was four ounces. In one case of suicide, at Bombay, 360 grains were found, and several times, over 100 grains were found. The discovery in the contents of the stomach after death of a large quantity of arsenious oxide to a certain extent indicates the probability of suicide. It, however, by no means negatives homicide, especially in India, where very large quantities are given, or attempted to be given, in homicidal cases. In *Cases* (*a*)–(*c*), p. 495, the quantity found was very large. *Case* (*a*), p. 469, is still more conclusive on this point, the victim being an adult instead of a child. Taylor also mentions two other cases, both charges of homicide, in which the quantity found was large (see *Cases* (*b*) and (*c*), p. 497).

Accidental cases.—Accidental poisoning from internal administration of arsenious oxide is sometimes met with, generally from the poison being mistaken for some inert mineral substance (see *Case*, p. 499) become by carelessness or accident mixed with articles of food. The possibility also that in some cases arsenious oxide is intentionally administered

[1] *Beng. Medico-legal Rept.*, 1870–72. [2] *Ibid.*
[3] *Med. Jur.*, II., p. 270.

without actual homicidal intent has already been alluded to (see *Case* (*a*), p. 496).

External application of arsenious oxide also occasionally causes fatal poisoning (see *Case* below). In another case referred to above, in which death did not take place for two years, the poison was applied in solutions to the skin for the cure of itch, its application being followed by an erysipelatous eruption. *Cases* (*a*) and (*b*), p. 500, are additional examples of this form of accidental poisoning. It may be here pointed out that the continued application of arsenious oxide to the unbroken skin, may cause an erysipelatous or eczematous eruption thereon. This may be followed by denudation of the epidermis, and sloughing and ulceration owing to the caustic action of the poison. The question as to what effect long-continued application of arsenious oxide has on the unbroken skin arose in the Baroda case (p. 496).

Case.—**Arsenical Poisoning by Puncture.**—A Bengali had scrotal tumour, and had been suffering from rheumatic fever for about a week. A person named Satyabadi Mangraj, ostensibly in the endeavour to cure the man, punctured the tumour, and applied some irritant or poisonous drugs to it, from the effect of which the man died. The left testicle and portion of the scrotum of the deceased, which exhibited puncture marks, were forwarded here for examination, and arsenic was detected in them.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Accidentally in food.—*Cases.*—(*a*) In Bombay some years ago, a number of school children were poisoned by swallowing portions of a mass of arsenious oxide which they had found lying on the ground.—(*b*) (*Bo. Chem. Analyser's Rept.*, 1873–74). Five lumps of arsenious oxide, weighing together 128 grains, were found in the stomach of a woman who died in the Jamsetjee Jeejeebhoy Hospital, Bombay. Her story was that she had eaten the arsenic in mistake for "khadu" (pipe-clay). "Khadu" eating seems to be a common practice among Hindu females. —(*c*) (Taylor, *Poisons*, p. 354). In the Bradford lozenge case a confectioner, intending to adulterate lozenges with plaster of Paris, mixed with them a quantity of white arsenic, which had been supplied to him through mistake. More than 200 persons were poisoned, of whom seventeen died.—(*d*) *In tea and coffee.*—Mr. C——, a resident of Bow Bazar, Calcutta, and his family and cook were seized, in 1899, with symptoms of irritant poisoning after partaking of tea and coffee prepared by his cook. The only one who escaped was a child, who took some of the warm milk with which the tea and the coffee had been prepared, but none of the tea or coffee. All members of the family, with the exception of this child, showed symptoms of irritant poisoning, vomiting and purging, and pain in the abdomen. The nephew and the cook suffered most severely, and were removed to the Medical College Hospital, where both of them died. The others recovered. The viscera of the cook was forwarded for examination, and arsenic was detected in them. A large quantity of white arsenic was found as a deposit in the kettle in which the water was boiled, and this was evidently the source from which the tea and coffee became contaminated with the poison. Arsenic was also detected in the vessels in which the coffee and tea were prepared, as well as in the coffee decoction. Neither the milk nor the sugar contained arsenic, hence the child escaped.

As to how the arsenic was introduced into the water kettle nothing could be ascertained. It was believed to be accidental, put in instead of soda to soften the water, especially as several cooks keep white arsenic in their kitchens to kill rats and cats.—(*e*) *In bread.*—A Mohammedan of Bow Bazar, Calcutta, found a poor woman of the neighbourhood sitting weeping at her door, and on his inquiring into the cause of her distress, she told him that she and her children were starving, and she had no means of getting food that day. The man, pitying her, bought five seers of flour from a shop close by, and made it over to her with a few pice to enable her to buy other necessaries. The woman prepared some *chapatis* (cakes) with a portion of this flour, and shared the bread with her two children and two co-lodgers. They all soon afterwards suffered from symptoms of irritant poisoning, and were removed to hospital, where their stomachs were washed out, and they were treated for irritant poisoning. They all recovered. The remaining *chapatis* and flour and the stomach-washings of all these persons were forwarded for examination. White arsenic was detected in the *chapatis*, and arsenic was detected in the stomach-washings. The flour from which the *chapatis* had been made contained no arsenic. How arsenic came to be mixed with the *chapatis* remained a mystery. Nearly all Mohammedans keep arsenic in their houses as a depilatory, and the poison is sold in the bazaar by the same shopkeepers who sell spices and salts. The risk therefore of this deadly poison finding its way accidentally into the food is very great.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(*f*) As **Love-Charm.**—A young Mohammedan wife, aged 14 years, who was in the habit of running away from her husband, had administered to her by the latter "some drug as a love-charm with the object of causing her to love him, and from the effects of which she died." The civil surgeon finding some of the internal organs congested, the mucous membrane of the intestines slightly congested in parts, and containing about two ounces of rice-water stools, ascribed the death to cholera, and did not send the viscera for chemical examination. The police, however, sent the vomited matter for analysis, and arsenic was detected in this as well as in the sugar which had been given to her.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 9.

Cases.—**Arsenical poisoning by External application.**—(*a*) (Taylor, *Poisons*, p. 304). The mother of a girl, *æt.* nine, rubbed some white precipitate ointment, mixed with arsenic, on her child's head, in order to kill vermin. No symptoms appeared until the fifth day, when the child seemed unwell and complained of thirst. There was slight purging, with cramps on the eighth day. Death took place on the tenth day. On *post mortem* examination, inflammation of the mucous membrane of the stomach and duodenum was found.—(*b*) (Taylor's *Manual*, p. 99; and Blyth, *Poisons*, p. 510). In 1876 a number of infants were poisoned in England by arsenious oxide contained as an adulterant in violet powder. Some of the powder was found to contain over 38 per cent. of As_2O_3. In one case, reported by Mr. Tidy, the powder was applied to the skin of a newly-born infant, at intervals, for three days. The skin became intensely red, and ultimately in some parts assumed a sloughy appearance. The child died on the tenth day.—(*c*) (Taylor, *Poisons*, p. 11). Two shepherds were engaged in sheep-dipping for nine hours, using a mixture of arsenious oxide and solution of carbonate of potash. Both suffered; one, on the fourth day after the dipping, had eczema of the scrotum, and vesicles on the thighs, slight fever, and great thirst. Dr. Watson, who reported this case, states that other shepherds, even when using As_2O_3 only, suffered from eruptions, chiefly on the hands, forearms, scrotum, and thighs.

Case.—**Arsenic poisoning by post.**—In August, 1899, Mr. P——, P. W. D., Shwebo, Burma, received a postal package from Rangoon containing a bottle of beer. He opened it, and being apparently suspicious, showed it to his native servant, who took a teaspoonful, and shortly afterwards became desperately ill. The contents of the bottle on being examined showed that the beer was charged as full as possible with arsenic. About the same date Mr. Green, of the Telegraph Department, Bhamo, received from Rangoon by post a packet of cocoa. When he opened it he saw arsenic, and handed the packet to the police. The packet has now been analysed, and shows enough arsenic in one spoonful to kill half a dozen men.—*Englishman*, 18th August, 1899.

Cattle-poisoning by arsenious oxide.—A large number of horned cattle are yearly poisoned in India.[1] With very few exceptions the poison used is arsenious oxide. Thus, in Western India, arsenious oxide was found in 714 out of 743 cases of cattle poisoning, reported to the Bombay Chemical Analyser's office during the ten years ending 1885. Nearly always, where the animals killed are horned cattle, they are poisoned for the sake of their skins.[2] The usual plan adopted is to make some powdered arsenious oxide into a paste with oil, and insert a mass of this, often wrapped in paper, into a cavity scooped out of a head of jowari or other grain, or enclose it in a bundle of grass. In a few cases, the arsenious oxide is mixed with one or other of the following: orpiment, realgar, red lead, litharge, or pounded glass. Cases of horse poisoning also sometimes come under notice. The motive for these appears generally to be to gratify spite against owner of the animals. In one case of horse poisoning, occurring in Bombay, a native gentleman lost seventeen horses in three months. The bodies of the first fifteen were not examined, but the sixteenth and seventeenth were both found to have been poisoned by arsenious oxide. The symptoms caused in cattle by administration of arsenious oxide and other poisons are similar to those in human beings.

Form.—Arsenious oxide is met with in the form of (*a*) white masses looking somewhat like lumps of white earthenware; these are at first translucent, but become opaque by keeping; (*b*) A more or less fine powder composed of irregular-shaped fragments, obtained by mechanically powdering form (*a*); and (*c*) A fine powder composed entirely or almost entirely

[1] In 1884, 288 head of cattle were reported to the Indian Chemical Examiners as killed by poison. In Bombay, 677 animals, almost all horned cattle, were killed by poison during the ten years ending 1884.

[2] By *Chamars* or *Chaklars* (leather-workers); or by *Mahars* or *Dhers* (Pariahs), who claim the bodies of animals dying of disease. Gribble remarks that he has found ordering the bodies to be buried in quicklime effectually stops cattle-poisoning in districts where this crime prevails.—*Med. Jur.*, p. 212.

of minute crystals. Forms (*a*) and (*b*) are the forms in common use in India; form (*c*) is only occasionally met with.

The difference in appearance under the microscope of forms (*b*) and (*c*) was a matter of much importance in the *Case* overpage. Powdered arsenious oxide is usually met with in England coloured with soot or indigo, as directed under the Arsenic Act (14 Vic. cap. 13),[1] and in case of poisoning it may be of importance to note the nature of the colouring matter found mixed with the arsenious oxide.

Case.—**The De Ga Case.**—In this case a number of the members of a Portuguese family of position, resident in Bombay, were poisoned by arsenic. The circumstances of the case were as follows: A man, believed to be a Hindoo, who afterwards disappeared and has never been traced, left at the family residence in Bombay a present of cakes. Some of these cakes were passed on to another house, where other members of the family resided, and these, in their turn, sent a portion to a third house. All who partook of the cakes suffered; three died. The cakes, on examination, were found to contain an interior layer of jam, mixed with a quantity of coarsely pounded arsenious oxide. In the course of the police inquiry into this case, suspicion arose that the poison had been abstracted from a particular druggist's shop in Bombay. It, however, turned out that the only arsenious oxide in this shop was a quantity contained in a jar. A portion of the contents of this jar, submitted to me for examination, proved to be entirely composed of minute unbroken crystals, much smaller in size than many of the fragments of arsenious oxide contained in the cakes. Hence it was highly unlikely that the poison found in the cakes had been obtained from the shop in question.—*Bo. Chem. Analysers Rept.*, 1872-73.

Properties.

Taste either absent or slightly roughish or sweetish; not strongly metallic, as is the case with many white irritant poisonous powders, or acid like oxalic acid. Specific gravity

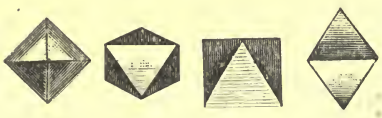


FIG. 28.—Sublimate of Arsenious Oxide Crystals × 100.

about 3·7. A pinch of powdered arsenious oxide weighs about 17 grains, a teaspoonful about 150 grains, and a tablespoonful about 530 grains.—Taylor. Solubility.—Cold water dissolves about half a grain to a grain per ounce. Boiling water dissolves more, and water boiled for an hour with it will take up

[1] Although the Sale of Poisons Act has been in force in Bombay for nearly twenty years, I can only recollect one case in which on examination I found powdered arsenious oxide mixed with one of the colouring materials mentioned in s. 17 of the Bombay Act.—I. B. L. 1888.

about 12 grains per ounce.[1] A much larger quantity of powdered arsenious oxide than this may, however, be suspended in mucilaginous fluids. When finely powdered arsenious oxide is mixed with water, a small quantity rises to the surface and floats thereon, forming a film. The fact that such a film was observed on a particular fluid supposed to have contained the poison administered, may be an important piece of evidence. Alkalies and alkaline carbonites, owing to the formation of alkaline arsenites, augment, and, according to Taylor, organic matter as a rule decreases, the solubility of the poison. Arsenious oxide is very soluble in hydrochloric acid. Effect of heat.—Solid arsenious oxide when heated volatilizes without charring or fusion. Its vapour, received on a moderately heated surface, condenses in minute crystals of characteristic appearance, the majority of which are more or less perfect octahedra (see Fig. 28).

Detection.—(1) By the effect of heat on the solid as stated above. (2) Boiled with water the solution of arsenious acid so obtained: (*a*) acidulated with hydrochloric acid yields a yellow precipitate with hydrogen sulphide, soluble in solution of ammonia; (*b*) yields a yellow precipitate with ammonio-nitrate of silver;[2] (*c*) gives a green precipitate with ammonio-sulphate of copper;[3] and (*d*) the solution (or the powdered solid), boiled with nitric acid and the fluid evaporated to dryness, yields a residue of arsenic acid, which when dissolved in water gives a red-brown precipitate with solution of silver nitrate. (3) Powdered arsenious oxide mixed with powdered charcoal and powdered sodium carbonate,[4] and heated in a narrow tube (the '*Reduction process*'), see Fig. 29, yields a sublimate of metallic arsenic as a ring, hair-brown in colour where the film is thin, and dark-grey or black and lustrous where thicker. Such a ring cut off and heated in a wide tube sublimes readily with formation of arsenious oxide, which condenses on the side of the wide tube in minute crystals of the characteristic appearance before noted. The wide tube should first

FIG. 29.—(*b*) Sublimate of Metallic Arsenic, by the Reduction Process.

[1] The absence of severe symptoms in the *Case* on p. 486, is no doubt attributable to the sparing solubility of the poison.

[2] Prepared by adding ammonia to silver nitrate solution, in quantity just sufficient to dissolve the precipitate at first thrown down.

[3] Prepared from copper sulphate solution, in a similar way.

[4] Black flux.

be warmed above the metallic ring, as arsenious oxide is apt to condense on a cold surface as an amorphous powder. This 'reduction process' may be used for the identification of other solid dry arsenical compounds, other than white arsenic. For details of Reinsch's and Marsh's tests see pp. 513–15. For testing for arsenic in bones, see p. 516.

In consequence of the delicacy of the tests for arsenious acid, that poison is readily found, if present, in exhumed bodies suspected to have died from arsenical poisoning, and also in the cremated remains of such bodies.

Case.—**Arsenic found in cremated body.**—In a case of suspected arsenical poisoning from Moughyr, in 1919, arsenious acid was found in the cremated remains of the woman.—Hemnath Adhikari in *Bengal Chem. Examiner's Report*, 1919.

Sulphides of Arsenic.

Two of these are in common use in India, viz. the yellow sulphide, orpiment, King's yellow or *Hurtal*, As_2S_3, and the red sulphide, realgar, *Sandaracha* or *Mansil*, As_2S_2. Both appear to be favourite medicines of the *hakims*, and to be in common use as depilatories; for this last purpose a mixture of orpiment and lime or carbonate of lime appears to be often employed. The yellow sulphide is largely used in India as a pigment for children's toys, painting tent poles and otherwise.

Orpiment is obtained in large quantities from the mines in Chitral on the borders of the Hindu Kush. The miners were described in 1899 as "crooked and bent, clothed in the most filthy rags, with dead yellow faces, almost the colour of the orpiment itself after being exposed to the air and light. They are small of stature and give one the idea of horrible gnomes. But worse than this—they are all pitted and scarred with the terrible marks of what, I believe, must be a sort of skin disease, due to constant contact with the pigment. The affection appears to take more violent hold on those employed in the orpiment industry the longer they are exposed to its baneful influence, but from inquiries made, it does not appear to cause death. It may be also that their unsightly bodies are made more so by the custom or habit they have got into of eating pieces of the pigment. They say it acts upon them the same way as a dram of brandy or other spirits upon us, and does them no harm, but our feelings in the matter prompted us to refuse any of the unappetising-looking stuff, which they offered to us." The orpiment is carried down to Peshawar, where it is sold for 12 to 15 rupees a maund (80 lbs.). It is also brought from the Nari Province of Northern Tibet to Bageshwar Bazaar near Almora.

Both sulphides, as met with in commerce, usually contain much arsenious oxide, and are more or less actively poisonous according to the quantity of arsenious oxide present, as the sulphide is insoluble in water and also HCl. In India the sulphides of arsenic are used for criminal purposes much less frequently than arsenious oxide.

In Bengal, etc., during the three years ending 1872, 223 cases of human poisoning by arsenious oxide were reported, as against 17 by the sulphides (all by orpiment). In Bombay, during the ten years ending 1884, sulphides of arsenic were detected in less than 6 per cent. of the total number of cases of arsenical poisoning brought to the notice of the Chemical Analyser to Government.[1]

Human poisoning by the sulphides.—None of the seventeen cases mentioned above were homicidal; nearly all appear to have been cases of suicide. Chevers,[2] however, gives details of two cases of attempted homicide by orpiment introduced into food; and Waddell[3] mentions three fatal cases of poisoning by orpiment, of which two were homicidal, in cases examined by his department in Bengal in one year (1884). In Bombay a few cases of poisoning or attempted poisoning by the sulphides have occurred, of which some (see *Cases* below) were cases of homicide or attempted homicide; the poison, in a few cases realgar, in a few others orpiment, and in a few the mixed sulphides, having been given, or attempted to be given, in articles of food.

Cases.—**Cases of poisoning by the sulphides of arsenic** (*Bo. Chem. Analyser's Repts.*).—(*a*) In Bombay several persons were poisoned, all of whom, however, recovered, by orpiment contained in food. The poison was introduced into the food in turmeric powder, which, on examination, was found to contain over 90 grains of orpiment per ounce.—(*b*) The wife of a man who was very ill with fever confessed to giving orpiment, apparently in some *congi* (rice-starch). The husband died three days afterwards; traces of arsenic were found in his viscera. The *post mortem* appearances were: much congestion, and inflammation in patches of the gastric mucous membrane; small intestines also inflamed, and in parts in a state approaching mortification; liver and spleen enlarged, and signs of commencing inflammation of both lungs.—(*c*) In another case orpiment was found in some cooked rice. A man who had partaken of a portion of this rice suffered from symptoms of irritant poisoning, but recovered.—(*d*) Several persons, all of whom recovered, were poisoned by bread made from flour in which, on analysis, orpiment was found.—(*e*) An apothecary, stationed in Sind, noticed some red powder at the bottom of a cup of tea he was drinking; this proved to be realgar. One of his servants, taxed with having attempted to poison his master, confessed to having put the powder in the tea at the instigation of a man, who told him that it was a charm which would lead to the early transfer of the apothecary.—(*f*) A woman having confessed to having given to a child, who died from arsenical poisoning, some sugar mixed with rat poison, this rat poison proved to be a mixture of flour and realgar.—(*g*) The servant of a shopkeeper at Karachi brought to his shop, as part of a meal intended for him, an omelette, in which some red powder was visible; this turned out to be realgar.—(*h*) In a case in which two persons died from poisoning by arsenic, some flour and bread, of which they had eaten a portion, was found to contain mixed orpiment and realgar.—(*i*) In a case of attempting poisoning some sweetmeat, forwarded for examination, was found to contain both realgar and orpiment.

[1] See *Appendix XIV.* [2] *Med. Jur.*, p. 123.
[3] *Beng. Chem. Ex. Rept.*, 1884.

Abortifacient use.—Orpiment seems to be sometimes employed as an abortifacient, or ingredient of abortifacient preparations.

In one of the 17 cases above noted orpiment appears to have been taken with the object of procuring abortion. In several cases in Bombay, orpiment was found in packets discovered in the possession of persons charged with procuring abortion; and in one or two cases in powders stated to have been given with this object. In one of these last-mentioned cases, the poison was apparently present in the form of sulpho-arsenite of calcium. In one or two cases it was mixed arsenious oxide and orpiment, in the paste used for arming obortion sticks. In another case in which it was stated that abortion had been procured by the local application of drugs, a board used for mixing, and two stones used for grinding the drugs employed, were found to be stained with realgar and red lead.

Detection.—When pure, the sulphides are practically insoluble in water and hydrochloric acid. Heated *per se*, they yield a mixed sublimate of sulphuric and oxide. Their identification is best effected by the reduction process, converting the ring of metallic arsenic obtained into arsenious oxide, to which, after solution in boiling water, the liquid tests for arsenious oxide may be applied.

Arsenites of Copper.

Two of these are in common use as pigments, namely, *Scheele's green*, $CuHAsO_3$ (acid cupric arsenite), and *Schweinfurth's* or *emerald green* (aceto-arsenite of copper), $3CuAs_2O_4 + Cu(C_2H_2O_2)_2$. Both are known in India under the name '*Hirwa.*' Both, although insoluble in water, are readily dissolved by the acid fluids of the stomach, and when absorbed give rise to the usual symptoms of arsenical poisoning. They are seldom used in India either by homicides or suicides; occasionally accidental cases occur. In Bombay, two instances of alleged attempt at homicide by arsenite of copper (see *Cases*, p. 507) have occurred; and several cases of suicide by arsenite of copper have been reported in Bombay and Calcutta. Cases of poisoning by the arsenites of copper usually arise either from their being used in ignorance to colour confectionery or toys or from their accidental absorption into the system from other articles coloured by them.

A whole family were poisoned by *halwa* (a kind of sweetmeat) thus coloured in Bombay, and Taylor records a fatal case arising from eating blancmange, coloured with arsenite copper. Again, in several instances, arsenite of copper is used to colour small sugar-plums known as *til-gul*, which are sold at the

Maakar Sakrant festival;[1] and Dr. W. Center states that the confectioners of Lahore use arsenite of copper to colour their wares.[2] Taylor mentions several instances of children being poisoned by confectionery coloured with these compounds. Cases of the second class are often cases of chronic or slow poisoning, arising from inhalation of particles of the poison, detached from wall papers coloured with arsenical green. Chevers mentions one such case as having occurred in India, also another where the poisoning resulted from sleeping in a bedroom, the walls of which had been coloured with arsenite of copper, loosely put on with size.[3] Children again are sometimes poisoned by sucking green arsenical paint off toys (see *Case* below).

Suicidal poisoning by arsenite of copper.—A case of poisoning by Scheele's green was referred by the Coroner of Calcutta in May, 1910.

Homicidal poisoning or attempted poisoning by the arsenites of copper (*Bo. Chem. Analyser's Rept.*).—(*a*) A woman was found in the act of putting something into a pot of drinking-water standing in the house of a Bhora (trader). She was seized, and a packet found in her hand, in which was a quantity of aceto-arsenite of copper. In the struggle the pot got broken, and the water spilt, but aceto-arsenite of copper was found in some earth collected from the spot.—(*b*) A woman charged a man, described as her "kept husband," with an attempt to poison her, by giving her in lieu of *gulchand* (a sweetmeat containing Indian hemp and conserve of roses) a substance which, on examination, was found to consist chiefly of sugar and arsenite of copper.—(*c*) A child, about ten months old, was admitted into the J. J. Hospital, Bombay, suffering from symptoms of irritant poisoning, the result of sucking the paint off a toy parrot painted bright green with arsenite of copper.

Detection.—Both arsenites of copper are soluble in solution of ammonia, with formation of a blue liquid, which on evaporation redeposits the compound. Both also are soluble in hydrochloric acid, the solution yielding (1) evidence of the presence of copper to the usual liquid tests for this metal (see copper), and (2) evidence of the presence of arsenic to Reinsch's process (which see, p. 513). The presence of arsenic in these compounds also may be demonstrated by the reduction process as directed for the sulphides. The presence of acetic acid in the aceto-arsenite may be recognized by heating the compound with sulphuric acid, when free acetic acid is liberated; or with sulphuric acid and alcohol, when acetic ether is evolved.

Other Poisonous Arsenical Compounds.

'Rough on Rats' has been used for suicide, see cases below.

Case.—**Suicide by 'Rough on Rats.'**—A young married Mohammedan woman, separated from her husband and living in Calcutta, committed

[1] In January. In one instance the *til-gul*, from a vendor's stock, green, red, and yellow sugar-plums, was coloured respectively with aceto-arsenite of copper, mercuric sulphide, and chromate of lead.

[2] *Ind. Med. Gaz.*, 1874, p. 116.

[3] *Med. Jur.*, p. 125.

suicide by eating 'Rough on Rats.' Arsenic was detected in the viscera, and in the washings of her stomach. The sample of 'Rough on Rats' of which the deceased had partaken was found to contain 81·02 per cent. of arsenious acid. The *post mortem* examination revealed the presence in the uterus of a four weeks' fœtus.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1896.

Fly-powder.—This is a black powder, consisting of, or containing metallic arsenic, partly converted into arsenious oxide. 'Fly-papers' (*Arsenate*, see below) were used as a source of arsenic in the Maybrick case (p. 485).

Arseniuretted hydrogen.—This highly poisonous gas is evolved when hydrogen is set free from materials, or in liquids, containing arsenic (see *Marsh's Process*, p. 515). A few cases of poisoning by it, all accidental, have been reported. **Alkaline Arsenites.**—These are more soluble in water than arsenious oxide. Cases of poisoning have been recorded from Fowler's solution (Liquor Arsenicalis B.P. and I.P.), which is a weak solution of potassium arsenite, coloured with compound tincture of lavender; strength, I.P., four grains of arsenious oxide to the ounce;[1] or B.P. of 1885, 4·375 grains to the ounce, or 1 per cent. Cases (see p. 495) have also occurred from the use of arsenious oxide, mixed with potassium carbonate solution (potassium arsenite), as sheep wash; and Taylor mentions a case in which 340 school-children were poisoned by drinking tea made with water from a boiler into which mixed arsenite and arsenate of sodium had been put, in order to cleanse it from deposit. 'Weed-killer' (Arsenate of Sodium) has caused several deaths by using the empty casks for culinary purposes or water storage (*Lancet*, 1891, 900). **Alkaline arsenates.**—These rarely give rise to cases of poisoning. Taylor[2] refers to three accidental cases, and gives details of one attempt at homicide; in the latter, arsenate of potassium was given in wine. Paper soaked in solution of an alkaline arsenate mixed with sugar is used for poisoning flies, under the name of *Papier Moure* or Fly paper. Arsenate of potassium is used for preserving skins, and has lately been imported into India for this purpose. Chevers[3] mentions two cases (both in Panjab) of attempted cattle poisoning by pieces of grass moistened with solution of potassium arsenate. Arsenic in **dyeing materials.**—A large number of dyes, of various colours, are obtained from rosaniline, a red colouring matter prepared by the action of an oxidizing agent (usually arsenic acid) on *aniline*. *Red aniline* dyes have been found to contain arsenic.

[1] This was the strength of the preparation of the B.P. of 1867.
[2] *Poisons*, p. 351. [3] *Med. Jur.*, p. 133.

Cacodylates of Arsenic. These have lately been introduced as antisyphilides under a variety of names, 'Atoxyl,' '666,' *Salvarsan*, etc. Many cases of poisoning by them are reported. Death from Salvarsan and allied preparations has frequently resulted from :—

(1) Extensive sloughing when administered subcutaneously or intramuscularly.

(2) From pulmonary thrombus and embolism through faulty technique in injecting muddy solutions intravenously.

(3) From hyperpyrexia, vomiting and purging. In these cases the *post-mortem* signs are generally injection and ecchymosis of the mucosa of the stomach (probably due to the fact that much of the arsenic is excreted into the stomach), in injection and parenchymatous inflammation of the kidneys and in many cases sub-endocardial hæmorrhages.

(4) A hæmorrhagic encaphalitis, coming on later with symptoms of paralysis and coma, characterized *post mortem* by dotted hæmorrhages in the brain and its membranes.

Double optic neuritis common in atoxyl poisoning is rare with Salvarsan.

The signs were identical in 19 horses dead through atoxyl intravenous injections for surra which Professor Powell examined *post mortem*.

Liquid reactions of arsenic acid.—Arsenic acid differs from arsenious acid in giving (1) a red-brown precipitate with silver nitrate, and (2) in moderately strong solution, a precipitate with a mixture of ammonia, ammonium chloride, and magnesium sulphate solutions. An acidulated solution of arsenic acid is precipitated by sulphuretted hydrogen much more slowly than a similar solution of arsenious acid.

Detection of Arsenic in Viscera, etc.

Arsenic is not a cumulative poison in the usual sense, as though temporarily deposited in organs, after absorption it is rapidly eliminated by the urine and other secretions, hence the importance of preserving the urine for analysis. Sir T. Stephenson found it in the urine for four days after a poisonous dose (Taylor, II., 490).

In the presence of organic matter, the ordinary tests for the recognition of arsenic become inapplicable. Further, the ready volatility of arsenic precludes incineration being employed for the destruction of organic matters mixed with it. Hence to separate arsenic from organic matter, and bring it into a form in which it may be readily recognized, special processes are required. For the detection of arsenic in bones, see p. 516. Before describing these, certain points bearing on the inferences to be drawn from the analytical results must be considered.

1. **Disappearance of arsenic from the body** (*a*) after death.—Arsenic, like other inorganic poisons, cannot disappear by putrefaction. Hence it may be detected in human remains after any period of interment. Its antiseptic power and the sparing solubility of its most commonly used compounds, tend specially to favour this. On the other hand, arsenic, being volatile at the temperature of combustion, may disappear when a body is burnt; though it has been detected in partly burnt bodies (see *Case*, p. 511). (*b*) Disappearance during life.—During life, vomiting and purging tend to free, first the stomach, and subsequently the intestines, from the poison. In exceptional cases complete disappearance from the contents of the stomach may take place very rapidly.

Taylor [1] mentions a case where this occurred within 24 hours; and I once met with a case in which arsenic could not be detected in the contents of the stomach of a woman who died from arsenical poisoning in six hours.[2] On the other hand, two cases are recorded, one of death in six, and the other of death in seven days, in both of which arsenic was found after death in the contents of the intestines.[3] During life also, absorption of the poison takes place very rapidly. Taylor found it in comparatively large quantity in the liver in a case of death in three hours.[4] Again, during life, absorbed arsenic tends to undergo elimination from the body, by the kidneys and other emunctories. Complete elimination may undoubtedly take place in 15 days, and may, there is good reason to believe, take place even in a shorter time than this (see *Cases* (*a*) and (*b*) below). On the whole, therefore, (1) Entire absence of arsenic from the body is quite consistent with the supposition of death (after some days) from arsenical poisoning; it, however, strongly indicates survival for some days; and (2) In case of a death from arsenical poisoning, absence of arsenic from the alimentary canal is a moderately strong indication that the individual lived some time after swallowing the poison, the indication being stronger if arsenic is found to be absent from the contents of the intestines, as well as from the contents of the stomach.

Cases.—**Death from arsenical poisoning.**—Complete elimination of arsenic from the body.—(*a*) (Taylor, *Poisons*, p. 335). A woman was charged with poisoning her husband by arsenic. The husband suffered from the usual symptoms of arsenical poisoning, and died from exhaustion on the fifteenth day. No arsenic could be found in the viscera of the deceased. Mr. Herapath, of Bristol, who made the analysis, stated that "neither in his reading nor experience had he known arsenic to have

[1] *Poisons*, p. 335.

[2] *Bombay Chem. Analyser's Rept.*, 1879–80. The poison was given in food; arsenic was detected in the liver.

[3] Taylor, *Poisons*, p. 336.

[4] *Ibid.*, p. 334.

been detected so long as 15 days after its administration."—(*b*) (*Bo. Chem. Analyser's Rept.*, 1874–75): "In a case from Ahmednagar, a man lived three days after a dose of about 75 grains of arsenic. He is said to have suffered during the whole time from purging and vomiting." Not a trace of the poison could be found in either the stomach or liver. Dr. Wellington Gray, who made the analysis, remarks in reference to this case: "It is quite possible that arsenic may have existed in the more distant tissues of the body, for the examination of which no opportunity was given." Arsenious oxide was detected in some bread, a portion of which had been eaten by the deceased.

Case.—**Detection in cremated remains.**—Two persons suffered from choleraic symptoms, and one of them died and was cremated; but when the other one also died in a few days, suspicion was aroused. The viscera of the latter and all the suspected articles connected with the case were sent for chemical examination, including ashes from the scene of cremation. Arsenic was found in the visceral matters and excreta, and even in earth scraped from the spot where the washings of a tumbler had been spilt. Interest attaches to the fact that appreciable quantities of arsenic were easily detected in the ashes and bones from the scene of cremation, contrary to expectation, for a volatile poison like arsenic would be dissipated by fire and lost beyond the possibility of detection in anything reduced to ashes; but the conditions under which cremation is usually carried out here evidently do not favour complete combustion, and sublimation of the volatilized arsenic on the cooler parts of the funeral pyre is liable to take place and its loss thus prevented. This is borne out by another such case which was examined during the year, in which arsenic was easily detected in ashes and charred bones, etc., sent from the cremation ground. The point is one which is worth noting by magisterial and police-officers who have to investigate cases of suspected poisoning, in which the corpse has been cremated.—*Mad. Chem. Ex. Rept.*, 1902.

Case.—**Detected in dead body after six months.**—The Civil Surgeon of Jessore sent a fleshy mass supposed to contain the remains of the abdominal viscera of a Mohammedan adult female who was reported to have died of cholera. The Magistrate on certain information suspected foul play in the case, and ordered the disinterment of the body after six months. The soft parts of the body were found dry and shrivelled and absent at places. The internal organs were indistinguishable. The history pointed to bloody stools passed before death. The fleshy mass on chemical examination was found to contain arsenic.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1912.

2. **Conversion** in the body of arsenious oxide into yellow sulphide of arsenic.—It has already been pointed out that this may occur; the reverse change cannot, however, take place. The discovery, therefore, of arsenious oxide in the body shows that the poison administered contained arsenious oxide. On the other hand, the discovery of yellow sulphide of arsenic in the body does not prove that the poison was administered in the form of yellow sulphide.

3. **Presence of arsenic in earth.**—Arsenic is sometimes found in minute quantity in earth, but has hitherto only been

found in earth in a form insoluble in water. It has been alleged, however, that arsenical earth may, under the action of the air, yield a soluble arsenical compound. Further, it has been found that when arsenic in solution is introduced into the alimentary canal of a dead body, *post mortem* imbibition takes place, and arsenic passing through the walls of the alimentary canal becomes imbibed by tissues external to but in contact therewith.

In the case, therefore, of an exhumed body, in the viscera of which arsenic has been detected, it may be alleged that the arsenic found therein was derived from the surrounding earth. Either of two cases may arise. The parietes of the body may be found (1) intact, or (2) not intact, and the viscera more or less mixed with earth. In case (1) the discovery of any notable quantity of arsenic in the body completely negatives the theory of earth derivation. The presence of traces even can hardly be accounted for in this way. In case (2) the earth derivation theory is in the highest degree improbable if a notable quantity of soluble arsenic is detected. Whenever, however, case (2) arises, a portion of the surrounding earth should always be submitted to analysis, and even in case (1) it is advisable to preserve a portion of the surrounding earth, so that it may be examined for arsenic, should traces only thereof be found in the body. In India vomited matters are frequently found mixed with earth; here, again, it is important to ascertain whether or not arsenic present in such matters, is present in a form soluble in water. Should soluble arsenic be present, and especially if it be present in notable quantity, earth derivation is improbable. Earth and gravel are often found in the stomachs of cattle. Hence the presence of a minute quantity of insoluble arsenic in the bodies of such animals may possibly be accounted for on the theory of earth derivation.

4. The wrappings or envelopes employed to enclose suspected poison or poisoned food sometimes contain arsenic; for example, yellow packing waxed cloth occasionally contains traces of arsenic—and this possibility should be excluded by a 'control' test.

Quantity of arsenic found.—The quantity of arsenic found in the viscera of an individual may, to a certain extent, affect (*a*) the presumption as to suicide or homicide; or (*b*) the presumption as to the cause of death, as has already been considered. Bearing specially on the possibility of a minute quantity of arsenic being discovered in the viscera, in a case of death from causes other than arsenical poisoning, are the following points:—(1) the existence of the habit of arsenic

eating and the frequent use by *hakims* of arsenic in the treatment of disease; (2) the possibility of earth derivation just discussed; and (3) the fact that arsenic is *not* a natural constituent of the body, although the contrary was at one time asserted. It must not be lost sight of also that arsenic may be present in small quantity, as an impurity, in drugs administered for medicinal or other purposes and in reagents. Antimony and bismuth [1] compounds are liable to contain traces of arsenic; so also is sulphuric acid, and it has already been mentioned that realgar has been found in opium.

Processes for separating Arsenic from Organic Mixtures.

The principal processes employed for the separation of arsenic from organic mixtures are: (1) deposition as metallic arsenic or copper, or Reinsch's process; (2) separation as arseniuretted hydrogen, or Marsh's process; (3) separation by distillation as chloride of arsenic; and (4) separation by precipitation as sulphide of arsenic. Many of the reagents used in the above process, *e.g.* sulphuric acid, hydrochloric acid, metallic zinc and metallic copper, are specially liable to contain arsenic. All should, therefore, be ascertained to be arsenic-free before use. As regards metallic copper, however, see Reinsch's process.

Reinsch's process.—This consists in boiling the suspected liquid acidulated with about one-fourth of its volume of hydrochloric acid (or solid matters cut into small pieces and mixed with hydrochloric acid diluted with about two volumes of water), with a succession of pieces of clean, bright, metallic copper foil or gauze.

The strip of copper used in the test should first be cleaned in the following way. Prepare a mixture containing water 100, sulphuric acid 100, nitric acid 50, and hydrochloric acid 2 parts. A few drops of this acid mixture are allowed to fall on the strip of copper. The acid is immediately washed off in running water and the copper at once used for the test (Hankin). If arsenic is present, a steel-grey or black stain—an alloy of arsenic and copper—forms on the

[1] Dr. Richardson, in the case of *R.* v. *Smethurst*, stated that in the bismuth usually administered in medicine (sub-nitrate) he had found nearly half a grain of arsenic per ounce, and that in one case, where for dyspepsia five grains of bismuth had been given three times a day for six days, he had found about a fiftieth of a grain of arsenic in the patient's urine. Dr. Thudicum, at the same trial, stated that he had found both arsenic and antimony in sub-nitrate of bismuth, and also in grey powder.

surface of the foil or gauze. The stained pieces of copper are then washed,[1] dried, and heated in a test-tube,[2] when the stain, if arsenical, disappears, and a sublimate of arsenious oxide is obtained, which, under the microscope, is found to consist of minute crystals of the characteristic appearance before noted. Unless such crystals are obtained, the presence of arsenic has not been demonstrated, because the staining of the copper may be due to (1) the action of organic matter only, or the formation of sulphide of copper; or (2) the deposition on the copper of metals other than arsenic, *e.g.* mercury, antimony, silver, bismuth, etc. Under the circumstances of the process, however, of the metals other than arsenic which deposit on copper, two only yield sublimates, viz. mercury, which yields a sublimate of minute globules of metallic mercury, and antimony, which yields a non-crystalline sublimate. Reinsch's process is the most generally applicable of all. It cannot, however, be used in cases where the liquid contains matters which dissolve the copper, *e.g.* nitrates, chlorates, or ferric chloride. It is only also in such cases that the presence of arsenic in metallic copper can lead to error.[3] Hence, if the copper dissolves, or the deposit forms only very slowly thereon, one of the other processes should be resorted to.

When carrying out Reinsch's test on vomit mixed with ashes, the addition of a further quantity of acid may be required, as part of the acid will have been neutralized by the alkali of the ashes. Occasionally in cases in which vomit has been mixed with earth, it will be found that the strip of copper during the boiling shows signs of corrosion and may ultimately dissolve. This effect is probably due to the presence of nitrates. Should this occur a fresh sample of the earth-vomit mixture should be placed in a basin with dilute hydrochloric acid and raised to the boiling point. Some powdered ferrous sulphide is then added. After boiling for a short time the mixture is allowed to cool and kept till the next day. It is then boiled for some time (to drive off H_2S) and the strip of copper is added. The arsenic if present

[1] The copper should be washed successively with water, alcohol, and ether. In some cases this is insufficient and, on heating the copper, charring occurs, and liquid sublimes over obscuring the arsenic crystals. Should this occur another piece of the copper having the arsenic deposit must be taken and placed in ether for twenty-four hours. If the copper is then taken out and dried with blotting paper, on heating it in a tube a perfectly clean arsenic sublimate will be obtained (Hankin).

[2] In the same way as the metallic ring in the reduction process (see p. 493).

[3] Unless such substances are present, the copper does not dissolve during the process. If the copper remains undissolved and becomes rapidly coated, an arsenical deposit formed on the copper cannot be due to the presence of arsenic in the copper employed.

will then be found to be deposited in the normal way (Hankin). A Windsor's clip is very useful in carrying out the Reinsch test. This consists of a glass rod of which the end has, while heated, been twice bent round parallel to itself. The rod thus prepared is used as a clip to hold the piece of copper (Hankin).

Marsh's process.—This consists in introducing a liquid suspected to contain arsenic, into a vessel from which hydrogen gas is being evolved. If arsenic be present, the nascent hydrogen attacks it, forming arseniuretted hydrogen. The arsenical nature of the gas evolved may be proved: (1) By passing it through a narrow hard glass tube, heated to redness for a portion of its length; when a deposit of metallic arsenic forms in the cool part of the tube beyond the heated portion. (2) By igniting the gas, and holding a piece of cold white porcelain in the flame, when a deposit of metallic arsenic forms thereon (see Fig. 30). (3) By passing the gas through solution of silver nitrate, when a black deposit of metallic silver is thrown down, and the arsenic is converted into arsenic acid, which remains in solution. The arsenical nature of these products of the process is proved as follows:—(1) The portion of the narrow tube containing the deposit or ring of metallic arsenic is heated in a wide tube, like the metallic ring in the reduction process (see p. 503). It volatilizes readily, yielding a similar crystalline sublimate. (2) The spots on porcelain, where thin, are seen to be hair-brown in colour, and (*a*) are soluble in chloride of lime solution, (*b*) are insoluble in stannous chloride solution, and (*c*) dissolved in aqua regia; the solution when evaporated to dryness, yielding a residue of arsenic acid, which gives a brick-red precipitate with silver nitrate solution. (3) The silver nitrate solution is treated with excess of hydrochloric acid, filtered, and the filtrate evaporated to dryness; silver nitrate solution added to the residue gives a brick-red precipitate. The apparatus used may be an ordinary gas-bottle, such as is employed for preparing hydrogen gas, fitted with a tube filled with fused calcium chloride (for the purposes of drying the gas evolved), to which is attached a long narrow hard glass tube, ending either in a jet or a downward bend. The materials used may be zinc and dilute sulphuric acid, or zinc and hydrochloric acid. A quantity of hydrogen gas must

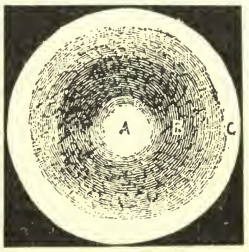


FIG. 30.—Deposit in Marsh's Test.

A.—Metallic Arsenic. B.—Mixed Metallic Arsenic and Arsenious Oxide (anhydride). C.—Arsenious Oxide (anhydride).

be allowed to escape before heat is applied to the narrow tube (avoidance of explosion). Before the suspected liquid is introduced, the narrow tube must be heated to redness for about fifteen minutes. If no deposit forms, the materials are arsenic-free. In this way the purity of the hydrochloric acid used in Reinsch's and other processes may be ascertained. Bloxam's modification of Marsh's process consists in evolving the hydrogen gas required by electrolytic decomposition of water acidulated with sulphuric acid. In this way the use of zinc (which frequently contains arsenic) is avoided. In another modification, Fleitmann's, applicable to arsenic but not to antimony, the hydrogen is evolved by heating zinc with potassic hydrate solution. Marsh's process is not applicable to the sulphides of arsenic, or to solutions containing arsenic as arsenic acid, or as an arsenate (see, however, below).

The chloride distillation process.—The substance under examination (cut into small pieces if a solid) is first thoroughly dried on a water-bath. The dry residue is then distilled to dryness with the strongest obtainable hydrochloric acid, and the residue in the retort distilled again to dryness with a little more of the same acid. Under these conditions, arsenic, if present, distils over as chloride of arsenic, and may be recognized in the distillate, by subjecting this to Reinsch's or Marsh's process.

To Test for Arsenic in Bones.—The bones are broken up into small pieces and placed in a flask. Sufficient concentrated sulphuric acid is added to cover them. The flask is heated till signs of charring and solution of the bones are manifest. The heating should be done over a sand-bath. A deep water-bath containing sand is preferable for the purpose. Sulphuric acid must not be heated over a water-bath containing water, as this might lead to a dangerous accident if the flask were to crack. After heating, the flask is set aside till the next day. Crystals of ferrous chloride are then added to the contents of the flask, and also about 150 c.c. of methyl alcohol. The flask is heated and the contents distilled. A current of hydrochloric acid gas is bubbled through the contents of the flask while the distillation is going on. The arsenic passes into the distillate, and should be collected in a receiver cooled with ice. Its amount may be estimated by means of Marsh's test (see Collins, the *Analyst*, vol. xxxvii., p. 229, June, 1912).

Precipitation as sulphide of arsenic.—Mixtures containing little organic matter may be boiled with dilute hydrochloric acid, filtered, and the filtrate precipitated by washed sulphuretted hydrogen. If much organic matter be present, this must be first destroyed by boiling the substance under examination (cut into small pieces if a solid) with dilute hydrochloric acid, and adding to the boiling liquid from time to time, a small quantity of crystallized potassic chlorate. The organic matter having been destroyed, the liquid is filtered, sulphurous acid added to it,[1] and washed sulphuretted hydrogen passed through it. The precipitated sulphide is separated by filtration, washed, dissolved in ammonia, the solution

[1] To reduce the arsenic acid, Marsh's process may be applied to the detection of arsenic acid and the arsenates, if these be first treated with sulphurous acid.

filtered, and the filtrate evaporated to dryness. The residue of impure sulphide of arsenic may then be subjected at once to the reduction process, or (for quantitative determination of the arsenic present) treated as follows:—Boil with strong nitric acid, evaporate to dryness, dissolve in a little water, filter, and add to the nitrate a mixture of solutions of magnesium sulphate, ammonium chloride, and ammonia. After twenty-four hours filter, wash the precipitate with ammonia-water, dry and weigh. It consists of ammonium magnesium arsenate, and contains 39·47 per cent. of metallic arsenic.

Antimony.

Antimonial poisoning is extremely rare in India. It usually arises from the potassio-tartrate or tartar emetic. A few cases also are recorded of poisoning by the chloride (butter of antimony).

Tartar emetic.—This, also called potassio-tartrate of antimony and tartarized antimony, produces effects on the system very similar to those produced by arsenious oxide. Unlike the latter, however, it has a strong metallic taste. Tartar emetic has a very marked depressant action on the heart, and on the nervous system generally. Hence, in poisoning by it prominent symptoms are extreme faintness, collapse, and muscular weakness. Loss of voice has been noticed, and choleraic symptoms,[1] and convulsions often precede death. In exceptional cases (as in arsenical poisoning), vomiting is slight or absent, necessitating the administration of emetics. Tartar emetic applied to the skin produces a pustular eruption thereon, and may become absorbed, giving rise to constitutional symptoms. A pustular eruption on the skin has also been noticed in cases of poisoning by internal administration of the drug.

Acute poisoning by tartar emetic is seldom homicidal; it is frequently accidental from the poison being mistaken for some harmless powder, *e.g.* Epsom salts, or carbonate of soda. It may also be remarked that, although tartar emetic is popularly well known to be a powerful emetic, it is not equally well known to be a powerful poison. It is possible that this may explain the mysterious Bravo case (see below).

Cases.—**Antimonial poisoning.**—**Homicidal.**—(*a*) The **Bravo** case (July, 1876). In this case Mr. Bravo, a young married man of good position, died undoubtedly from poisoning by tartar emetic. Deceased, on the evening he was attacked with symptoms of poisoning, stated—so one of the witnesses at the inquest deposed—that, owing to jealousy of his wife, he had taken poison. Shortly after this he became very ill, and medical assistance was sent for. Sir W. Gull, one of the physicians called in, stated that he told the patient that the symptoms were due to poisoning, and asked him how he came by it. He answered, "I took it myself."

[1] Christison, *Poisons*, p. 432 (2nd Ed.).

Asked what he had taken, he replied, "Laudanum." Told that he must have taken more than laudanum, he said, "Before God, I only took laudanum." There was no evidence to show how deceased came by the tartar emetic, from the effects of which he died, and the coroner's jury returned a verdict of wilful murder against some person or persons unknown.—(*b*) *Reg.* v. *Smethurst* (Browne and Stewart's *Trials*, p. 448). In July, 1859, Thomas **Smethurst,** a surgeon, was tried at the Central Criminal Court for the murder by poison of Isabella Bankes, a lady with whom he had contracted a bigamous marriage. Deceased, just before her death, made a will, leaving all her property to the prisoner. The medical witnesses for the prosecution deposed that, in their opinion, the cause of death was slow poisoning by some irritant, and on analysis traces of antimony were found in the viscera of deceased. For the defence, it was urged that several of the symptoms of slow poisoning by arsenic or antimony were absent; *e.g.* there was no conjunctivitis, no skin disease, and no excoriations at the orifices. That the symptoms, etc., might have been due to acute dysentery. That the vomiting and diarrhœa from which deceased suffered might have resulted from her being in an early state of pregnancy. That the traces of antimony found in the viscera (and a minute quantity of arsenic found in an evacuation passed by deceased) might have been due to the presence of arsenic in the bismuth, and of antimony in the grey powders, administered as medicines. The prisoner was convicted. Subsequently memorials, backed by the opinions of eminent medical men, were presented to Government in the prisoner's favour and he was pardoned.—(*c*) Case of Dr. **Pritchard** (*ib.*, p. 397). In July, 1865, Dr. Pritchard, of Glasgow, was tried for the murder of his wife and mother-in-law, the first by slow poisoning with antimony, and the second by poisoning with antimony and aconite. Antimony was found in the viscera of both. The prisoner was convicted, and subsequently confessed his guilt.—(*d*) *R.* v. **Klosowski,** C., in *Times*, March 20, 1903, was an important case.

Chronic poisoning.—Some remarkable trials for murder, by the administration of repeated small doses of tartar emetic, have taken place in England (see *Reg.* v. *Smethurst*, and Dr. Pritchard's trial, *Cases* (*b*) and (*c*), *supra*). In some cases of chronic antimonial poisoning, the failure of ordinary medical treatment to control the prominent symptoms, viz. nausea, vomiting, and diarrhœa, with great depression and muscular weakness, has been the first thing to excite suspicion as to the true nature of the case.

Preparations containing tartar emetic.—Vinum antimoniale B.P. and I.P. contains 2 grains of tartar emetic per ounce. Tartar emetic is also contained in small quantity in several quack pills, *e.g.* Dr. Johnson's, Mitchell's, and Dixon's pills,[1] and forms one-fifth by weight of the Unguentum antimonii tartarati B.P. and I.P. Fatal period.—Shortest recorded, seven hours (in a female, *æt.* 21).[2] Longest, one year.[3] Usual,

[1] About one-sixteenth to one-twenty-fifth of a grain in each pill (Blyth, *Poisons*, p. 547).

[2] Wormley, *Poisons*, p. 218.

[3] Guy's *For. Med.*, p. 426.

ten hours to four days. Fatal dose.—Smallest (in a child), three-quarters of a grain. Largest non-fatal, half an ounce. Taylor considers that, under circumstances favourable to the action of the poison, ten to twenty grains taken at once, might prove fatal to an adult; but that, if taken in divided doses, a smaller quantity might suffice.[1] *Post mortem* signs.—Similar generally to those of arsenical poisoning. Aphthous inflammation of the mouth, throat, and gullet, and aphthous ulceration of the small intestines, have been observed. Treatment.—The usual treatment for irritant-poisoning, with the administration as an *antidote* of an infusion containing tannin, *e.g.* solution of tannic acid, decoction of oak-bark, or of cinchona bark, or strong tea. Stimulants may be required to counteract depression.

Other Antimonial Compounds.

Trichloride, or Butter of Antimony, $SbCl_3$.—A strong solution of this is used for browning gun-barrels; also sometimes in surgery as a caustic; and in pharmacy as a source of oxide of antimony. It is highly corrosive, giving rise, when swallowed, to symptoms of corrosive poisoning, plus constitutional effects similar to those caused by tartar emetic. A few fatal cases of poisoning by the chloride of antimony are recorded. In one of these narcotism succeeded the usual irritant symptoms. The *post mortem* appearances are those of corrosive poisoning. Antimony, trioxide, Sb_2O_3, although insoluble in water, is soluble in the fluids of the stomach. It is used in medicine in the form of Pulvis antimonialis—an imitation of the old James's powder—a mixture of one part of oxide of antimony to two of phosphate of lime. Its action on the system is similar to that of tartar emetic, but milder in degree. Over-doses of it have given rise to dangerous symptoms. Antimony trisulphide, Sb_2S_3.—This is met with in two forms: (1) as a black crystalline mass or powder—native sulphide of antimony, black antimony, or 'surma';[2] and (2) as an orange-coloured powder—precipitated sulphide of antimony. Although pure sulphide of antimony is probably inert, the following points of medico-legal interest attach to it: (1) Commercial black sulphide of antimony frequently contains arsenic, hence—if not first thoroughly purified—tartar emetic prepared from it is liable to contain arsenic. (2) The orange sulphide of antimony, plus a variable proportion of antimony trioxide, forms the antimonium sulphuratum of the B.P. and I.P., and this forms about one-fifth by weight of Plummer's pills (Pilula hydrargyri sub-chloridi, composita, B.P. and I.P.).[3]

Detection of antimony.—Antimony after absorption is eliminated mainly by the urine, and may be detected during life in this fluid. It is probably eliminated from the body at least as rapidly as arsenic. Like arsenic also, antimony does not disappear by decomposition, and has been detected in the body after long periods of interment.

[1] *Poisons*, p. 464.

[2] Used in India as a collyrium. Women, according to Balfour (*Cyclopædia*, iii. 248), always use kohl or lamp-black instead of surma.

[3] The presence of antimony, as an occasional impurity, in grey powder and ubnitrate of bismuth, has already been noticed.

Detection of antimony in **organic mixtures.**—To Reinsch's process (*see* p. 513) antimony, like arsenic, yields a deposit on copper, which, however, sublimes only at a high temperature, yielding an amorphous sublimate of Sb_2O_3. For Reinsch's process in the case of antimony, the galvanic deposition process may be substituted. This consists in placing in a concentrated hydrochloric acid solution of the matters under examination, a slip of platinum foil, with a piece of pure zinc in metallic contact therewith. Metallic antimony is deposited on the platinum. The stained platinum is washed, boiled with nitric acid, the acid solution evaporated to dryness, and the residue dissolved in dilute HCl, and tested for antimony by hydrogen sulphide. Deposits of antimony obtained by Marsh's process may be similarly treated. To Marsh's process antimony yields deposits distinguishable from arsenical deposits (p. 515) as follows: (1) The metallic ring in the tube is deposited closer to the heated portion, is sublimable only with difficulty, and yields no sublimate of octahedral crystals. (2) The spots on porcelain are smoky black (not brown), insoluble in chloride of lime solution, but slowly soluble in stannous chloride solution. (3) In the vessel containing the silver nitrate solution, the antimony falls (as antimonide of silver) with the deposit, and may be recovered by boiling the deposit for some time with tartaric acid. Precipitation as sulphide.—The organic matter may be destroyed in the same way as when this process is used for separation of arsenic. The precipitated sulphide may then be collected, and dissolved by boiling it with strong hydrochloric acid, and the amount of antimony present estimated volumetrically by a standard solution of iodine; the antimony solution being first treated with sodium tartrate and carbonate, to weak alkaline reaction.[1]

Mercury.

One of the most poisonous salts of mercury—the perchloride—is sold in every bazaar and is kept in the shops alongside spices, so that accidental poisoning is not uncommon in India.

Mercurial poisoning may be acute or chronic.—If acute, the symptoms may be either those of corrosive or those of non-corrosive irritant poisoning. If chronic, either salivation or mercurial tremors, or both, may be present; and in two cases of chronic poisoning by an organic mercurial compound (mercuric methide) the brain was specially affected.

Acute mercurial poisoning is rare in India. Accidental cases are, however, occasionally met with, and very rarely homicidal cases.[2] Symptoms.—Acute mercurial poisoning most commonly arises from swallowing corrosive sublimate, in which case, and also when the nitrates are swallowed, the symptoms present are those of corrosive poisoning.

[1] Under the conditions stated, Sb_2O_3 oxidizes into Sb_2O_5. The end reaction is the permanent appearance of free iodine in the liquid under test.

[2] In one such case the deceased, a prostitute, died from the effects of an irritant poison administered to her in sweetmeat by a man, afterwards tried and convicted of her murder. It was alleged that the poison used was *ruska-pur* (see calomel), but the evidence on this point was very unsatisfactory (Chevers, *M. J.*, p. 266). See also *Case* above.

In acute cases other than these, the symptoms are those of non-corrosive irritant poisoning, and vary in severity according to the activity of the compound swallowed. Mercuric compounds are more active than mercurous compounds. Soluble mercurial salts have a strong metallic taste. In corrosive cases (1) intense burning pain in the mouth and throat comes on immediately, and (2) the lining membrane of the mouth and throat becomes white and shrivelled. These characters are absent in non-corrosive cases. In both corrosive and non-corrosive cases the usual symptoms of irritant poisoning are present, and more or less complete suppression of urine is a common symptom. In some cases coma has been observed. If the case is prolonged, salivation, as in chronic poisoning, may appear; but this is not a common symptom in acute cases.

Case.—**Acute Mercurial poisoning.**—A convict, in Port Blair, was brought to the hospital on the evening of the 3rd September, 1896, in a very low condition, suffering from great pain in the throat and abdomen, and passing bloody stools and vomiting bloody matter. He said he had been bitten by a centipede in the leg, and as he was in great pain some one gave him a draught to take, saying that it would relieve him. He swallowed the draught and immediately he felt a burning in his mouth and gullet. Directly afterwards the whole throat became painful, and he could hardly swallow, and he became restless. Soon he began to vomit food mixed with blood and passed bloody stools with great pain. He was in this condition when brought into the hospital. In the hospital he had all the symptoms of irritant poisoning. Besides bloody stools and vomit, he had suppression of urine followed by bloody urine in very small quantities. The whole of the fauces were inflamed. Soon the mouth and gums became ulcerated, followed by loss of many teeth. He became very low day by day, as he could not take nourishment well. He constantly complained of pain and burning sensation in his abdomen, and was always very thirsty. There was, however, no fever, until he got diffused cellulitis of the left side of the neck, face, and forehead, and he died on the 12th October, 1896. His viscera, stools, and the vomit which he had ejected on admission into the hospital were forwarded for examination. Traces of mercury only were detected in the portions of viscera sent for analysis. But both mercury and arsenic were detected in his vomit and stools. It appears from this case that mercury is not so easily eliminated from the system as arsenic. For although the man was in the hospital for nearly a month and a half, traces of mercury were still detected in his viscera, but no arsenic could be found in them. In this case, as the symptoms of mercurial poisoning were so marked, and as the quantity of arsenic found in the stools and vomit was so very small, it may be presumed that arsenic was present in only small quantity as an impurity in the mercurial preparation which had been administered to the deceased.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Post mortem signs.—These, according to the case, may be those of corrosive, or those of non-corrosive irritant poisoning. Perforation of the stomach is rare. The gastric mucous membrane may be found covered with a greyish deposit of metallic

mercury, or there may be a black deposit of the sulphide. The intestines and urinary organs are generally much congested. In acute poisoning from external application of mercurial compounds, *post mortem* appearances of irritation of the alimentary canal are present.

Treatment.—The usual treatment for corrosive or irritant poisoning, with the administration as an antidote of albumen (*e.g.* white of egg) or other albuminous fluids.

Chronic mercurial poisoning is liable to arise in persons whose occupation exposes them habitually to the vapours of metallic mercury or its compounds, or to constant contact with mercurial compounds. It may also arise from often repeated small doses of any mercurial preparation, and hence may result from the abuse of such preparations in the treatment of disease. Cases of this last description used formerly to be of frequent occurrence in India. Symptoms.—These may be debility, nausea, and vomiting, accompanied by colicky pains, and followed by salivation. In other cases, mercurial tremors are the first symptoms to appear.

Salivation.—This commences with a coppery taste in the mouth. The gums swell and become tender and spongy. There is profuse ptyalism, fœtor of the breath, and febrile disturbance. A blue line may be present on the gums. In extreme cases, the tongue and cheeks swell, ulceration appears in the mouth, the jaws become necrosed, and the teeth drop out. Mercury is present in the saliva. Salivation may (1) last for almost any period: in one exceptional case it is said to have lasted six years. (2) Intermit, and recur after an interval of three months or more. In exceptional cases also, an interval of three months or more has been observed between the discontinuance of mercurial treatment and the first appearance of salivation. (3) Appear in acute cases, but rarely appears in these under twenty-four hours, although one case is reported where it appeared in three hours. (4) Arise from very small doses.—Idiosyncrasy in some cases renders an individual specially sensitive to the action of mercury; a case, for example, is recorded where salivation was caused by two grains of calomel. In other cases, idiosyncrasy appears to have the opposite effect. Children, it may be noted, bear mercury better than adults. (5) Arise from causes other than administration of mercury.—Thus it has resulted from the administration of compounds of arsenic, antimony, copper, lead, bismuth, and gold; also from administration of iodine, sulphuric acid, hydrocyanic acid, digitalis, cantharides, colchicum, croton oil, opium, carbolic acid,

and nitro-benzene, and may occur idiopathically. In non-mercurial salivation, mercury is, of course, absent from the saliva. Cancrum oris, a disease liable to affect children, especially those that are cachectic or badly fed, has been mistaken for mercurial salivation. Taylor[1] mentions a case in which a child, having died from cancrum oris, a charge of malpraxis was brought against the medical attendant. It was, however, proved that no mercury had been administered. Mercurial tremors, or shaking palsy.—This as a rule comes on gradually, affecting first the muscles of the arms, and subsequently those of other parts of the body. The affection begins with unsteadiness and quivering, increasing to tremors, which ultimately become so violent as to resemble convulsions. All voluntary movements requiring the aid of the affected muscles can only be performed by violent starts. In advanced cases, walking, articulation, and mastication all become affected. Finally there is loss of memory, sleeplessness, delirium, and death. The skin is dry, and has a brown tint. Salivation may or may not be present.

Mercurial Preparations and Compounds.

(*a*) **Corrosive sublimate,** Mercuric chloride. $HgCl_2$.—*Talachikna sumbul Darchikna* (*Hind.*). This occurs in heavy crystalline masses, or as white crystalline powder. In the crude form, as obtained in the bazaars, it is an impure mixture with subchloride.

Heated, it melts and sublimes in prismatic crystals. It is freely soluble in alcohol and ether, and is soluble in sixteen parts of cold or three of boiling water, and more soluble in solutions of alkaline chlorides than in pure water.

The ordinary medical dose is one-sixteenth to one-eighth of a grain, and three to five grains may be regarded as a minimum fatal dose. A case of recovery after swallowing an ounce is on record. The usual fatal period is one to five days, but in one case death occurred in half an hour. Corrosive sublimate is readily absorbed through the unbroken skin, and acute poisoning, non-corrosive in character, may arise from its absorption. It is contained, to the extent of half a grain per ounce, in the Liquor hydrargyri perchloridi B.P. and I.P.

Case.—**Corrosive sublimate.**—Suicide.—In a case of suicide by mercurial poisoning, nearly eight grains of corrosive sublimate were found in the visceral and vomited matters. The unfortunate individual suffered such intolerable agonies from the poison that he rushed into the back

[1] *Poisons*, p. 370.

yard and jumped into a well, from which he was rescued and taken to hospital. He was a photographer by profession, and the chemical examination was extended to every substance found in his dark room, besides the examination of various articles of food and drink, before suspicion which rested upon innocent persons was removed.—*Mad. Chem. Ex. Rept.*, 1898.

Case.—**Corrosive sublimate in pudenda**—Homicide—Death.—In 1898, in Madras, a man surreptitiously thrust a piece of corrosive sublimate into the pudenda of his wife to punish her. Intense local inflammation resulted, followed by ulceration and constitutional symptoms, from which the woman died 12 days after. Accused got 10 years' rigorous imprisonment.—*Mad. Chem. Ex. Rept.*, 1898.

(*b*) **Nitrates of mercury,** viz. normal mercurous $Hg_2 2NO_3$ and normal mercuric $Hg 2NO_3$. These salts are freely soluble in water containing nitric acid, but pure water is liable to decompose them, with formation of sparingly soluble basic nitrates. Heated, they decompose, giving off red fumes of nitric oxide, and leave a residue of mercuric oxide. Swallowed, they produce symptoms similar to those caused by swallowing corrosive sublimate. A fatal case from external application of nitrate of mercury in a liniment is recorded; also a case of chronic poisoning from its use as a local application to the neck of the uterus; and another case where a workman whose occupation for four years had been packing skins brushed over with solution of nitrate of mercury, died of chronic mercurial poisoning; others, however, similarly employed in the same factory were unaffected.

(*c*) **Other compounds**—(1) **Mercuric cyanide** $Hg(CN)_2$.—This is a white soluble salt which, when heated, gives off an inflammable gas (cyanogen), and yields a sublimate of metallic mercury. Although non-corrosive, it is little less active than corrosive sublimate; ten grains has caused death. A case of acute poisoning (non-fatal) from swallowing the sulpho-cyanide $Hg(SCN)_2$, is recorded. This, more correctly mercuric thiocyanate, is sold in little cones as a toy under the name of *Pharaoh's serpent*, so called from the serpentine form of the copious ash yielded by them when burned. Each cone weighs about 3 or 4 grains. (2) **Subsulphate,** Turpeth mineral, $HgSO_4(HgO)_2$.—This is a yellow powder which, although sparingly soluble in water (1 in 2000 in cold, and 1 in 600 of boiling), has a strong metallic taste. Taylor mentions two fatal cases, in which the quantities swallowed were respectively forty and sixty grains. (3) **White precipitate** — Ammoniated mercury — Mercurammonium chloride, NH_2HgCl.—This is prepared by adding solution of ammonia to solution of corrosive sublimate. It is a white powder which

when boiled with water becomes yellow. It is soluble in nitric acid, but insoluble in water, alcohol and ether. According to Taylor, it frequently contains mercuric chloride as an impurity. It is only used medicinally as an external application for the cure of parasitic affections. Swallowed, it has caused severe symptoms in several cases, and at least one death. Chronic poisoning has arisen from its external application. Cases of recovery after swallowing thirty, forty, and one hundred grains, are recorded. (4) **Oxide—Red precipitate.**—This in its usual form is a red powder, slightly soluble in water. Heated strongly, it decomposes, with evolution of oxygen. When prepared by precipitation it is yellow in colour, and in this form is contained in the Lotio hydrargyri flava B.P. Cases of poisoning by it are rare. A fatal case from swallowing an ounce, and a case of recovery after swallowing half an ounce, have been reported. (5) **Sulphide** Cinnabar or 'Chinese *Sindur*,'[1] Vermilion, *Hingula* (*Mar.*) *Hingul, Rasa sindura* or *Shingarf.*—This is met with either as a dark red crystalline mass, or as a bright red powder. It is only soluble in nitro-muriatic acid, and is entirely volatilized by heat. No acute case of poisoning by it in man has been met with, but cases of chronic poisoning have occurred from its use as a colouring matter for vulcanite plates supporting artificial teeth. A case of chronic poisoning from its overuse as a fumigant is referred to by Taylor. (6) **Methide.**—In two cases of slow poisoning by inhalation of mercuric methide vapour, in addition to salivation, there was impairment of the special senses, of motor power, and of the cerebral functions generally. In one of the two death took place by coma. In the other the patient became idiotic, and after remaining in this state for a year, died of pneumonia.

Case.—**Sulpho-cyanide of mercury poisoning.**—In 1865, a *Pharaoh's Serpent* was swallowed by an adult male, who in consequence suffered from pain, dyspnœa, vomiting and rigors, but ultimately recovered. Blythe records an experiment, in which 0·5 gram (about 7½ grains) of the poison administered to a pigeon, killed the bird in 40 hours "without convulsions." The bird was "indisposed," but no other symptoms were noted. In November, 1904, a case is reported by Dr. C. L. Bose:—Tarangini, a sickly Hindu female child, aged 14 months, took by accident a piece of a "*Pharaoh's Serpent*" on the 7th November, 1904, at 7 A.M. These toys were kept in a small basket with other fireworks on the previous night, which was the *Dewali.* The contents of the basket were removed on the next morning, and some parched rice was given to the child in the same basket, but one piece of the toy remained in the basket undetected, and this the child took with the parched rice. The child experienced a disagreeable taste, which found expression in her face and

[1] This vernacular name *Chīna Sindūr* is because it comes from China, as distinguished from the ordinary Sindūr called Matiya Sindūr or 'earthy' lead oxide.

which attracted the attention of the attendant, who put his finger into her mouth and brought out a small quantity of a yellow sulphur-like stuff, which was at once recognized to be a portion of the toy. Shortly after, she began to vomit, attended with severe retching. The matter first brought up consisted of frothy mucus mixed with the pale-yellow substance she had taken. She vomited several times within half an hour; she was then removed to a neighbouring dispensary, where she was given two doses of sulphate of zinc (15 grains each) followed by warm water drink. This brought on copious vomiting. The vomited matter was of a yellowish colour mixed with much mucus. At about 8 A.M., the child was brought to me. She was weak and sleepy, apparently from exhaustion, otherwise, she was not bad. I advised small quantities of a mixture of milk and eggs to be given to her at frequent intervals, with 15 drops of brandy. The child brought up the first two doses of the egg mixture, but after that there was no more vomiting. The child remained sleepy and prostrated for about three hours, and then began gradually to recover. The bowels were not moved, and she made water for the first time at 3 P.M., after the ingestion of the poison, and then freely again at about 5.30 P.M. She had fever in the evening (temperature 101° F.), which kept on during the night. There was no more vomiting and no purging. She slept well during the night and was found all right next morning. As in the case of poisoning by other salts of mercury, the symptoms were of an irritant nature.

On chemical analysis of the substance, *mercury* and *sulpho-cyanic acid* were detected, and when burnt, it kindled and swelled into a bulky snake-like mass.

Mercurous compounds.—Insoluble or sparingly soluble mercurous compounds are much less actively irritant than similar mercuric compounds. Mercurous compounds are, however, prone to become converted into mercuric compounds. Some mercurous compounds, *e.g.* the oxide and iodide, undergo this change spontaneously, or under the influence of light only. Others, *e.g.* calomel, are more stable, but this even is liable under certain conditions to become converted in the body into mercuric chloride. Of the sparingly soluble or insoluble mercurous compounds, the only one of medico-legal interest is: **Mercurous chloride,** Calomel—'*Ras-kafur*,' 'mercurial camphor,' on account of the vitreous camphor-like appearances of the masses of crude calomel, which is in India largely mixed with perchloride. Calomel occurs as a heavy, white, crystalline mass or amorphous powder, almost tasteless, and insoluble in water, alcohol and ether. It is entirely volatilized by heat and is blackened by solution of ammonia. The *ras-kafur* of the Indian bazaars contains a considerable but varying quantity of corrosive sublimate. An ordinary medicinal dose of calomel is two to five grains. In large doses it acts as an irritant poison, and in exceptional cases fatal salivation has been caused by ordinary medicinal doses. At the temperature of the body calomel is liable to be converted into corrosive sublimate by solutions of sodium or potassium chloride, and specially by

solutions of ammonium salts. In at least the following two cases death appears to have resulted from this transformation.

Cases.—**Mercurous poisoning.**—Fatal result attributed to the conversion of calomel into corrosive sublimate.—(*a*) (Edinburgh *Med. and Surg. Jour.*, vol. liv., 1840, p. 250).—A physician prescribed for a child, powders containing in each $\frac{1}{2}$ a grain of calomel, 5 grains of ammonium chloride, and 5 grains of sugar. After taking a few of these powders the child died, with all the symptoms of poisoning by corrosive sublimate. The apothecary who made up the prescription was charged with causing the death of the child, it being supposed that he had by mistake substituted corrosive sublimate for calomel. This led to experiments being instituted, the result of which was to clearly show that calomel, by the action of ammonium chloride solution, is at the temperature of the body, and even at ordinary temperatures, decomposed, with formation of mercuric chloride and metallic mercury. (*b*) (*Bo. Chem. Analyser's Rept.*). In the year 1860 the following case was referred to Dr. Haines, then Chemical Analyzer, Bombay, for opinion. A soldier in hospital at Canton, suffering from fever, was ordered pills, each containing three grains of calomel, two to be taken every two hours, with two spoonfuls of a mixture composed as follows:—Ammon. sesquicarb ℥ij; Liq. ammon. acet. ℥vj; Water ℥vj. After two doses symptoms of gastric irritation came on, but two more doses appear to have been taken before the medicine was stopped. After several days' treatment the man died, and after death violent inflammation and ulceration were found in the stomach and pharynx. Experiments made by Dr. Haines with reference to this case showed that, at the temperature of the body, solution of acetate of ammonia decomposes calomel, with formation of mercuric chloride and metallic mercury, the action being more rapid if excess of carbonate of ammonia is also present.

Metallic mercury.—*Rasa Para*, or liquid metallic mercury, when swallowed even in large quantity (one to two pounds), seldom produces any ill-effect. In exceptional cases, however (*Cases* below), symptoms of chronic mercurial poisoning have been produced. A popular belief appears to exist in some parts of India to the effect that liquid mercury, when swallowed, causes injury to health. It was administered with this object in *Cases* (*b*), (*c*) and (*d*). Metallic mercury in vapour, or in fine division, readily acts on the system; hence workmen in mercury mines, barometer makers, mercurial gilders and platers, and others who are constantly exposed to mercury vapour, are liable to suffer from chronic mercurial poisoning, especially from mercurial tremors. The action of mercury in fine division is very similar to that of an insoluble mercurous salt, and in fine division it may be absorbed through the unbroken skin, and cause chronic poisoning. Mercury in fine division forms one-third by weight of Pilula hydrargyri B.P. and I.P. (blue pill), and Hydrargyrum cum creta B P. and I.P. The finely divided mercury contained in the latter preparation, is, in hot climates, liable to undergo conversion into mercuric oxide, the preparation as a consequence becoming poisonous.

Cases.—**Mercurial poisoning.**—Metallic mercury swallowed.—(*a*) (Taylor, *Poisons*, p. 360). For the purpose of causing abortion, a girl swallowed 4½ ounces by weight of mercury. It had no effect on the uterus, but in a few days she suffered from a trembling and shaking of the body (mercurial tremors) and loss of muscular power. These symptoms continued for two months, but there was no salivation, and no blue mark on the gums.—(*b*) (*Bengal Med. Legal Rep.*, 1869). The following case was referred to Dr. Bateson, Civil Surgeon, Umballa.

An individual was charged with attempting to poison a woman by administering to her liquid mercury in food. The woman is said to have vomited twice after taking the mercurialized food, and to have had "a red swelling of the gums, with bleeding on pressure of the finger," attributed by the sub-assistant surgeon who saw the case to the action of mercury. At the first inquiry the charge broke down, owing to the sub-assistant surgeon stating that mercury (liquid metallic) was not a poison. A conviction, however, was subsequently obtained, apparently under *s.* 328 of the *Penal Code*. Remarking on this case, Dr. Bateson says: "It seems it is customary, anyway about here, to administer mercury in some thickish food to spite an enemy, to thwart an intrigue, or to punish accessories to one. The present case belonged to the last kind."—(*c* and *d*) (*Bo. Chem. Analyser's Rept.*, 1874–75). In two cases during this year metallic mercury was found in articles of food; in one 29 grains of mercury were extracted from a small quantity of sweetmeat, and in another three grains were extracted from some food.

It may be remarked that in above case (*b*) the question arose, Is liquid mercury a poison? On this point, Taylor[1] says: "Although liquid mercury is not in itself poisonous, it is liable to be converted into poisonous compounds in the body." *Cases* (*a*) and (*b*), however, show that liquid mercury sometimes acts as a poison.

Detection of Mercury.

Elimination of absorbed mercury takes place mainly by the urine and saliva, and may be rapid or slow. The first is most likely to occur in cases of acute poisoning by a soluble mercurial salt, such as corrosive sublimate. Mercury was found to be completely absent from the viscera in a fatal case of poisoning by corrosive sublimate lasting only four days; and Taylor agrees with Orfila in considering that, if in acute poisoning by corrosive sublimate the individual survives fifteen days, it is probable that no mercury will be found in the body. Hence death may occur from mercurial poisoning, and analysis fail to detect the presence of mercury. On the other hand, elimination of mercury occurs in some cases very slowly, and mercurial preparations are often used in the treatment of disease. Hence the discovery of mercury in small quantity in the viscera of a deceased individual, is quite consistent with the supposition of death from causes other than mercurial poisoning.

Solid compounds are most readily identified by reduction. The compound is mixed with powdered sodic carbonate, or powdered sodic carbonate and powdered charcoal, introduced into a test-tube and heated, when globules of metallic mercury sublime. In solution—

Mercuric salts[2] give (1) a yellow precipitate with potassic

[1] *Poisons*, p. 360.

[2] If the salt under examination is mercuric cyanide, it should be decomposed by HCl before other reagents are added.

hydrate; (2) a white precipitate with solution of ammonia; (3) a scarlet precipitate with potassium iodide soluble in excess; (4) no precipitate with hydrochloric acid; (5) a white precipitate, subsequently becoming grey or black, with stannous chloride; and (6) with sulphuretted hydrogen a precipitate at first white, subsequently orange, and lastly black. Mercurous salts give (1) a black precipitate with potassic hydrate, or solution of ammonia; (2) a white precipitate with hydrochloric acid or chlorides, blackened by ammonia; (3) a black precipitate with sulphuretted hydrogen; (4) with potassium iodide solution, a green precipitate, soon changing to grey if excess be added.

In organic mixtures mercury may be detected by Reinsch's process.—On heating the coated copper, a sublimate of globules of metallic mercury is obtained. Or the matters having been boiled with dilute hydrochloric acid (1 to 4), the solution may be treated by the galvanic deposition process, as for antimony, using gold foil in place of platinum foil. The coated foil is then heated in a tube as in Reinsch's process (p. 513). Quantitative estimation of mercury may be effected by precipitating it as sulphide. Corrosive sublimate present in sufficient quantity in organic mixtures may be separated therefrom by exhaustion with ether.

Zinc.

Poisoning by this metal is rare in India, and usually accidental, from swallowing either the sulphate or the chloride. Of these the first is a non-corrosive, and the second a corrosive irritant. Besides their local action, zinc compounds, when absorbed, exert a remote specific action on the nervous system, causing great prostration of strength, collapse, convulsions, and, in some cases, impairment of special sensation, *e.g.* of smell, sight, and taste.

Zinc sulphate, white vitriol, $ZnSO_4$—*Safed tutiya.*[1]—This is a white crystalline, freely soluble salt, the crystals of which closely resemble in appearance those of magnesium sulphate.[2] In a few instances zinc sulphate has been used criminally, but, as a rule, cases of poisoning by it are accidental, and arise from its being mistaken for magnesium sulphate. When swallowed, it rapidly causes free vomiting, leading to complete, or almost complete, ejection of the poison; hence fatal cases are rare. Symptoms.—The usual symptoms of non-corrosive irritant

[1] *i.e.* White metallic salt.

[2] And also those of oxalic acid.

poisoning, with cramps, convulsions, and great prostration of strength. *Post mortem* appearances.—Those of irritant poisoning. Dose.—The least quantity likely to prove fatal cannot be stated with certainty. Half an ounce has caused death, but a dose of two ounces has been recovered from. As an emetic, zinc sulphate is given, in doses of ten to thirty grains, but it should be borne in mind that zinc sulphate is a poison. Hence if, as is sometimes the case in narcotic poisoning, vomiting is not produced, repeated doses are to be avoided. Acetate of zinc appears to act similarly to the sulphate, and may be used instead of it as an emetic.

Zinc chloride, $ZnCl_2$.—This is a white, very soluble, and very deliquescent salt, easily fusible, and in the solid condition often met with in cylindrical sticks. A strong solution of it—over 200 grains per ounce—is sold as a disinfectant, under the name of Sir William Burnett's disinfecting fluid. Cases of poisoning by zinc chloride are usually accidental, and most commonly arise from swallowing Burnett's fluid. A case, however, is recorded where death resulted from the application, by a quack, of zinc chloride as a caustic to a cancerous breast. Symptoms.—When swallowed in concentrated solution, as is usually the case, the symptoms are those of corrosive poisoning, followed, unless death occurs rapidly, by nervous symptoms, *e.g.* muscular weakness, tetanic convulsions, impairment of sight, etc. *Post mortem* appearances.—The lining membrane of the mouth and throat may be found bleached and white, or abraded and inflamed. The gastric mucous membrane has been found grey and corrugated, or inflamed, and in places destroyed; in one case the stomach was found perforated in two places. Where life has been prolonged, contractions of the gullet and stomach have been found. Dose.—Severe symptoms have been produced by twelve grains of the chloride. Half an ounce of Burnett's fluid has caused death, but recovery has taken place from doses of one to one and a half ounces.

Treatment of zinc poisoning.—The usual treatment for corrosive or non-corrosive irritant poisoning, according to the case. Carbonate of soda should be given as an antidote. Albuminous fluids may also be administered.

Detection.—Solutions of zinc salts (1) acidulated with HCl, give no precipitate with sulphuretted hydrogen; (2) give a white precipitate with ammonium sulphide; (3) give a white precipitate with ammonia solution, soluble in excess; (4) give a white precipitate with potassic hydrate solution, soluble in excess, and forming a solution from which sulphuretted hydrogen

throws down a white precipitate; (5) if a solution of a zinc salt be precipitated with sodic carbonate, the solution boiled, and the precipitate collected and ignited with a little cobalt nitrate solution in a platinum dish, the residue in the dish becomes bright green. From organic mixture, zinc may be separated by burning away the organic matter. The ash may be dissolved in dilute acid, zinc obtained from the solution as sulphide, the sulphide dissolved in a little nitric acid, and the solution treated as in (5) above.

Copper.

In India attempts at homicide, by the administration of the sulphate of copper in food or sweetmeat, are not uncommon, but the strong disagreeable metallic taste of this and other soluble copper salts, prevents their being used homicidally to any great extent.

Acute copper poisoning.—The accidental cases of poisoning by food cooked in copper vessels, tolerably frequent in India, are probably ptomaine or bacillary infection. Suicidal cases (see *Case* below) and cases where the poison has been taken with intent to cause abortion, and homicidal cases (*see* below) are occasionally met with: and a fatal accidental case in a child, from sucking pieces of the sulphate has been reported.

Case.—**Sulphate of copper poisoning**—Suicide.—A Eurasian lady in Calcutta, in 1897, took a large quantity of sulphate of copper, and died from the effects thereof. The mucous membrane of the stomach and upper intestines were stained blue. About 58·6 grains of sulphate of copper were recovered from the stomach alone. Copper sulphate is rarely used as a poison, either for homicidal or suicidal purposes, on account of the large dose which is necessary, its disagreeable taste, the great pain which it causes, and its uncertain results.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1879.

Case.—**Sulphate of copper**—Homicidal poisoning.—In 1880 a whole family were poisoned (not fatally) by a discharged khitmatgar introducing blue vitriol into the food. Sulphate of copper was detected in the remains of food.—Dr. Warden, *Beng. Chem. Rept.*, for 1880.

Symptoms.—A strong metallic taste in the mouth, followed by violent vomiting, and the usual symptoms of non-corrosive irritant poisoning. The vomited matters are usually bluish or greenish, becoming deep blue on addition of ammonia (coloration due to bile is unaffected by ammonia). In severe cases these irritant symptoms may be followed by convulsions, paralysis, and insensibility. In severe cases, also, suppression of urine is common; and jaundice, not present in arsenical or mercurial

poisoning, is a tolerably constant symptom. Fatal cases are rare. One ounce of the sulphate has caused, and probably less might cause, death, but doses of more than an ounce have been recovered from. Death has occurred (in the case of the child mentioned above) in four hours. In adult cases the fatal period is usually about three days. *Post mortem* signs.—Those usual in non-corrosive irritant poisoning, plus a yellow tinge of the body, and a blue or green colour, deepened by ammonia, of the contents of the stomach and intestines. Perforation of the intestines has been observed.

Treatment.—The usual treatment for non-corrosive irritant poisoning, with the administration, as an antidote, of albumen or albuminous fluids.

Chronic copper poisoning.—This has been met with, but is not common, among workers in metallic copper and its salts. It is also reported to have arisen from the use of plates as supports for artificial teeth, made of gold largely alloyed with copper. More frequently chronic copper poisoning has been traced or attributed to the contamination of articles of food with copper. The presence of copper, however, in articles of food habitually consumed, provided the quantity present be minute only, does not seem to give rise commonly to chronic poisoning. Symptoms.—At first lassitude, giddiness and headache, loss of appetite, and a constant metallic taste in the mouth. Afterwards, great muscular debility, a constant desire to vomit, and diarrhœa, with colicky pains. A purple or green line may be present on the gums, and in some cases the hair is said to have acquired a greenish tint. Acute colic, with constipation and local paralysis (symptoms of chronic lead poisoning), are absent in chronic copper poisoning. Treatment.—General, as indicated by the symptoms, and immediate removal from toxic influence.

Contamination of articles of food.—Copper salts have been used to colour pickles, preserved fruits and vegetables, and confectionery. Sulphate of copper also has been added to bread, in order, it is said, to promote the fermentation of the dough, and make the bread whiter. Articles of food are very liable to become accidentally contaminated when prepared or kept in copper vessels. On metallic copper (1) pure water has no action if the copper be clean and the air excluded, but if the water is boiled in contact with the copper, and air be present, solution takes place; (2) the solvent action of water on copper is increased when saline matters, especially ammonium salts and chlorides, are present in solution therein; (3) acid and

fatty food materials, boiled and allowed to cool, even in perfectly clean copper vessels, take up copper, but acid food materials, boiled in clean copper vessels and poured out at once, do not dissolve the metal; (4) in all cases the liability to contamination is greater if the copper vessel used is dirty. Copper cooking vessels are frequently tinned inside for protection; the tin used should be free from lead, otherwise chronic lead poisoning may result.

Metallic copper, except in very fine division, may be regarded as inert. Cases of chronic poisoning among coppersmiths, from constantly handling metallic copper, have been reported in England; and also cases among workmen using, as in certain printing processes, copper in a state of very fine division.

Sulphate of copper, or "Blue Vitriol," *Mora tut* or *Nila tutia,* is readily obtainable in India, and it occurs in blue, efflorescent crystals, which, when heated, lose water and fall into a colourless powder. The salt is very soluble in water, its solution responding to the tests for copper and combined sulphuric acid. Medicinally it is given internally in one-quarter to two-grain doses as an astringent, and in five to ten-grain doses as an emetic. A few cases of its use in India, as a human and cattle poison, have been met with.

Case.—**Copper sulphate as homicidal poison.**—In a fatal case of suspected poisoning by a husband of his wife's paramour, at Goalpara, Assam, in 1919, copper sulphate was found in the vomit and stains on the clothes of the deceased, and copper salts in the viscera.—Hemnath Adhikari, *Bengal Chem. Exr's. Rept.*, 1919.

Subacetate or "Verdigris"—*Zangal* or *Pitra.* Several subacetates of copper exist, all compounds of normal cupric acetate and cupric oxide. They are blue or green in colour, partly soluble in water; are used as pigments, and appear to be as poisonous as the sulphate. Half an ounce of the subacetate has proved fatal to an adult. Food contaminated with copper, derived from vessels in which it has been prepared or kept, commonly contains copper either as subacetate, or as carbonate (natural "Verdigris"). The subacetate, prepared by boiling or steeping metallic copper in an acetous organic fluid, is a common popular emetic remedy in India in cases of poisoning.

Other copper salts.—Green verditer and blue verditer, both oxycarbonates, and Brunswick green, an oxychloride of copper, all used as pigments, are poisonous. So also are the arsenite and aceto-arsenite (see p. 496). The symptoms

produced by these last two compounds, however, are those of arsenical poisoning.

Detection.—Copper in minute quantity is nearly always present in the human liver and kidneys, and in the liver and kidneys of domestic animals. Traces of copper have been detected also in wheat and barley, and in a large number of vegetables. Articles of food, again, frequently contain copper in minute quantity as an accidental impurity.[1] Hence the detection of copper in minute quantity in human viscera is quite consistent with death from a cause other than copper poisoning. Solutions containing copper give (1) a dark brown, almost black, precipitate, with sulphuretted hydrogen; (2) a blue precipitate with ammonia, dissolving in excess, with formation of a deep blue or purple solution; (3) a blue precipitate with potassic hydrate, insoluble in excess; (4) a chocolate-brown precipitate with potassium ferrocyanide; and (5) when slightly acidulated with sulphuric acid, deposit metallic copper on a clean iron wire. Organic matters containing copper may be incinerated, the ash treated with nitric acid, again incinerated, and the residue dissolved in dilute hydrochloric acid; the solution is then filtered and tested for copper as above. Or for quantitative estimation, the solution may be poured into a weighed platinum dish, a piece of metallic zinc added: this dissolves, the copper deposits on the dish as metallic copper, and after washing and drying, may be weighed in this form.

Lead.

Lead poisoning is not common in India. It is usually accidental. It may be acute or chronic. In acute cases the symptoms are those of non-corrosive irritant poisoning, except that there is constipation, not diarrhœa. In chronic cases, much more frequently met with than acute cases, the characteristic symptoms are colic and local paralysis, met with accidentally in painters, typesetters and men in charge of storage batteries.

Acute lead poisoning: symptoms.—When a soluble compound, *e.g.* the acetate, is swallowed, a burning pain in the mouth and throat comes on soon after swallowing the poison, followed by vomiting, and afterwards by colic with constipation. The fæces, if any be passed, are black. Cramps of the flexors follow, and there may be paralysis of the extensors and a blue

[1] Traces of copper are frequently present in native liquor. Lyon found traces of copper in about 80 per cent. of a large number of samples purchased in different districts of the Bombay presidency.

line on the gums, as in chronic poisoning. Giddiness, stupor, and even coma have been observed. Sparingly soluble compounds cause similar effects, except that the first symptoms do not appear until some hours after swallowing the poison. Fatal cases are rare. *Post mortem* appearances.—More or less redness of the mucous membrane of the alimentary canal may be found, but this is not always present. Treatment.—Promote vomiting or use the stomach-pump, and then give sulphate of magnesia as an antidote. Subsequently, opium may be required to relieve pain, and purgatives to overcome constipation.

Cases.—**White Lead poisoning by mistake for Betel-lime.**—Two cases are reported by Dr. C. L. Bose of poisoning by white lead which was accidentally used by mistake for betel-lime. The poisoned betel was remarked to be bitter in taste and used continuously for three days; on the fourth day severe colic and vomiting occurred, with bleeding from gums but no paralysis. Both recovered. Lead was detected in the urine of one of the men about six weeks after the poisoning.—*Calcutta Med. Jour.*, February, 1916.

Chronic poisoning.—May arise from swallowing, inhaling, or external application of lead or its compounds. Hence it is met with in those whose occupation exposes them to constant contact with lead or lead compounds; and is also met with as the result of wilful or accidental contamination of articles of human consumption or use with compounds of lead. In chronic lead poisoning, lead colic, or lead palsy, one or both may be present. Lead colic, painter's colic, or colica pictonum.—In this the prominent symptoms are: at first, indigestion, constipation, and feeling of depression, with loss of appetite, thirst, a metallic taste in the mouth, and fœtor of the breath. Afterwards there is pain about the umbilicus, usually relieved by pressure, hard, obstinate constipation, and quick, shallow respiration. The urine is scanty, there is a blue line on the gums, and sometimes delirium at night. Vomiting is a common symptom, but febrile disturbance is rare. Lead palsy.—This may be the first to appear, or it may follow after one or more attacks of lead colic. It usually commences in the extensor muscles of the hand and forearm, causing **wrist-drop.** Afterwards the muscles of the lower extremities may become affected, and even the muscles of the trunk. As in lead colic, there is a blue line on the gums. Blue line on the gums is believed to be due to a deposition of lead sulphide in the capillaries, and is rarely absent in chronic lead poisoning. A similar line has, however, been observed in chronic poisoning by other metals, *e.g.* mercury and silver. Other effects of lead on the system are: (1) it checks the elimination of uric acid, predisposing, therefore, to gout; (2) insanity in some cases, it is believed, is

traceable to chronic lead poisoning; (3) in pregnant females lead poisoning predisposes to miscarriage, and it (4) may cause albuminuria.

Chief occupations exposing to risk of lead poisoning are lead miners, smelters, and refiners; plumbers, pipe layers, printers, and type founders. Lapidaries, barmen, and fishmongers also suffer; the first from handling masses of lead in which precious stones are embedded while being cut; the second from constantly handling pewter pots; and the third from contact with wet, lead-covered surfaces, on which fish are commonly exposed for sale. Again, cupellers, makers of white and red lead and other lead compounds, painters and dyers, and others using lead pigments, flint-glass makers, and potters using lead glaze, are all liable. Chronic lead poisoning in non-workers in lead is most frequently due to accidental contamination of drinking-water with lead. It may, however, arise from accidental contamination or wilful adulteration of matters other than drinking-water. Contamination of drinking-water.—Pure water has no action on lead if air be excluded; but if air be present, lead hydroxide, slightly soluble in water, is formed. This, by the action of carbon dioxide, becomes converted into a basic carbonate of lead, insoluble in water, but soluble in solution of carbonic acid. The solvent action of water on lead is favoured by the presence of ammonium salts, especially ammonium nitrate. On the other hand, sulphates, phosphates, and carbonates retard or prevent the action. Hence, drinking-waters, free, or nearly free, from ordinary saline impurities, are especially liable to contamination from lead pipes, lead-lined cisterns, etc.

Accidental contamination of other matters.—This may arise from the article having been made, or from its being preserved, in vessels made of or soldered with lead, or in earthenware vessels glazed with lead glaze, or other vessels painted inside with a lead paint. Sometimes the contamination is mechanical in character, assisted, perhaps, by oxidation of the lead: *e.g.* chronic lead poisoning has arisen from the use of flour ground with stones filled in with lead; and from the use of farinaceous foods, or snuff, or tobacco, wrapped in lead foil. In other cases, the contamination arises from a solvent action exerted by the article, such action being specially liable to be exerted by (1) fatty and saccharine matters, and (2) acid matters (except those acid from the presence of sulphuric acid). Thus, milk kept in lead or lead-glazed pans, sugar made in lead vessels, and soup kept in lead-soldered tins, are all liable to contamination. Again, chronic lead poisoning has

arisen from drinking cider and beer conveyed in lead pipes; from drinking wine contained in bottles in which shot, used for cleaning them, have been carelessly left; from eating pickles contained in lead-capped jars; and from drinking new rum, contaminated with lead from the lead worm of the distilling apparatus. Old rum, however, is generally free from lead, owing to its precipitation as an insoluble compound, by tannic acid contained in the wood of the casks in which the rum is kept.

Wilful adulteration, etc.—Acetate of lead has been added to cheap wine in order to sweeten it. Red lead and chromate of lead have been used to adulterate snuff, and to colour articles of confectionery. Chronic lead poisoning has arisen from the use of hair dyes, cosmetics, and lotions, containing lead; and from the external application of white lead as a dressing to a scalded surface.

Chronic poisoning is sometimes met with in India as the result of the contamination of drinking-water, and also as the result of the administration of oxide of lead in quack medicines.

Treatment and prophylaxis.—In chronic lead poisoning the first indication of treatment is immediate removal from the toxic influence. In the case of non-workers in lead, the discovery of the toxic influence is frequently a matter of difficulty, necessitating the analysis of all matters habitually used by the patient. Colic may be treated by a combination of purgatives and anodynes: *e.g. Epsom salts* and senna followed by opiates. In both lead colic and lead palsy either soluble sulphates or iodide of potassium may be given, or the two may be combined, each dose of iodide of potassium being followed after an interval of two hours by a small dose of sulphate of magnesia. Workers in lead should be recommended extreme cleanliness, the least possible contact, and the use as a drink of very dilute sulphuric acid. Every precaution also should be taken to remove or keep down lead dust in the workrooms. The following processes have been recommended for the protection of drinking-water conveyed in lead pipes: (1) lining the pipes with tin, and (2) keeping the pipes filled for some time with water containing sulphates, or with a solution of an alkaline sulphide. Where, however, a water is liable to contamination, the use of lead pipes, lead-lined cisterns, etc., should be entirely avoided.

Metallic Lead is generally regarded as powerless to cause acute poisoning. A case, however, is reported of semi-acute lead poisoning from swallowing small shot, and another where death resulted from accidentally swallowing a quantity of melted

lead, the lead in this case acting as a mechanical irritant. Chronic cases, due to the action of metallic lead, are often met with.

Soluble Lead Salts.—(1) **Acetate of lead,** sugar of lead.—This is a white crystalline salt, very soluble in water, sparingly soluble in alcohol, and insoluble in ether; heated, it chars, yielding no sublimate. It is not very poisonous, and has been given in divided doses to the extent of eighteen grains, or even more, daily for a week or ten days without ill effect. The same quantity in minute doses, spread over a longer period, would be far more likely to cause serious symptoms. One ounce has often caused acute poisoning. Fatal cases are rare. (2) **Subacetate,** Goulard's extract, is generally met with in strong solution, formed by digesting strong solution of the normal acetate with PbO. The solution is frequently milky, owing to the action of atmospheric carbon dioxide. Its action is similar to that of the acetate. (3) **Nitrate of Lead** a white crystalline salt, very soluble in water, but insoluble in alcohol, is probably as poisonous as the acetate.

Sparingly Soluble or Insoluble.—(1) **Litharge**—Monoxide of lead, *Massicot.—Murdasang,* yellow or reddish-yellow in colour, is slightly soluble in water. Two tablespoonfuls of it have been swallowed without ill effects. Chevers, however, mentions two cases of chronic poisoning, arising from its use by quacks in India as a cure for syphilis. In one, serious symptoms came on after swallowing twenty-five grains daily (mixed with white sugar) for five days. In the other, two *sowars* (troopers) suffered from lead colic, after swallowing on each of three successive days, one hundred and twenty grains of litharge mixed with sixty grains of '*bans lochan*' (tabashir). In Europe, litharge has often given rise to chronic poisoning, frequently indirectly, from the solvent action of acetic, fatty, or other acids upon it. (2) **Red Lead,** Minium—Sindura.—The toxic action of this is similar to that of litharge. Taylor mentions a case where a woman recovered after swallowing 2¼ ounces. In this case no symptoms appeared for nine hours. Red lead (in the Bombay Presidency, and possibly in other parts of India also) often forms an ingredient of the paste used for arming abortion-sticks (see p. 314). In a case recently tried in Bombay, a woman, a professed abortionist, convicted of causing miscarriage, was found to have in her possession a number of sticks so armed. Red lead, alone or mixed with arsenious oxide, is sometimes in India employed as a cattle poison. (3) **White Lead** or carbonate of lead, $PbCO_3$, containing a variable quantity of lead hydroxide, is insoluble in water,

but soluble in dilute acids. One fatal case of acute poisoning by it in a child *æt.* five, is mentioned by Taylor. In this case, although no urgent symptoms were present for three days, the child died in ninety hours.

(4) **Chloride of Lead,** $PbCl_2$, slightly soluble in cold, more soluble in boiling water, has in one case—non-fatal—caused acute poisoning. An oxychloride is also met with, used as a paint, under the name of Turner's yellow. (5) **Chromate of Lead,** $PbCrO_4$, a yellow insoluble salt, used as a paint under the name of chrome yellow, has, in one or two instances—owing to its having been used to colour confectionery—caused fatal acute poisoning. As already mentioned, it is used to colour the sweetmeats known as '*til-gul*.' (6) **Sulphate of Lead,** $PbSO_4$, a white insoluble salt; is said to be inert. But Woodman and Tidy remark that this is doubtful, as "cases are recorded of sempstresses being poisoned by sucking thread mixed with sulphate of lead, for the purpose of increasing its weight." (7) **Sulphide of Lead,** Galena, PbS.—This, like sulphide of antimony, is sold in India under the name of *Surma*, for use as a collyrium. Owing to its insolubility, it is probably either inert or only very slightly active. No case of poisoning by it appears to have been recorded.

Detection.—Lead salts in solution give (1) (except the solution be very weak), with hydrochloric acid, a white precipitate not dissolved or blackened by ammonia, but soluble in boiling water; (2) with sulphuretted hydrogen in slightly acidulated solutions, or with ammonium sulphide in neutral or alkaline solution, a black precipitate; (3) with potassic hydrate, a white precipitate soluble in excess; (4) with potassium iodide, a yellow precipitate, soluble in boiling water, and crystallizing out on cooling in minute silky crystals; and (5) a yellow precipitate with potassium chromate. Insoluble lead compounds (the sulphide and sulphate excepted) are readily dissolved by nitric acid. The sulphide is only partly dissolved by boiling with nitric acid, the remainder being converted into sulphate. The sulphate may be identified by boiling it with carbonate of ammonia solution; this converts it into carbonate, which, after separation and washing, may be dissolved in acetic acid, and the solution tested for lead. From organic mixture lead may be recovered from incineration; the ash, if treated with sulphuric acid and again incinerated, yields sulphate of lead, which may be decomposed and brought into solution as above.

Other Metals.

Tin.—The only compounds of this metal of medico-legal interest are stannous chloride, $SnCl_2$, and stannic chloride. Solid crystalline hydrates of these salts may be met with, but more commonly the salts are met with in strong acid solution. They are used as mordants in dyeing, and are active irritants. Cases of poisoning by them are rare. Solution of carbonate of ammonia and albumen are indicated as antidotes. **Bismuth.**—Bismuth poisoning is more common now that 'Bismuth meals' are given for X-ray purposes. In one, an adult died in nine days from ʒii of the subnitrate; in another, recovery took place from a dose ʒvi. The symptoms were irritant. In the fatal case, suppression of urine, salivation, and delirium were present and well-marked *post mortem* appearances of irritation were found. Subnitrate of bismuth, Taylor remarks, frequently contains arsenic acid (see also footnote, p. 513).

Silver.—The only salt of this metal of toxicological importance is the nitrate. This is a powerful corrosive irritant, and has, in two or three cases, caused death. Accidental poisoning by this salt sometimes arises from a portion of a stick slipping down the throat while being used as a caustic. Common salt is the best antidote. In chronic poisoning by silver, a blue line appears on the gums, and the whole surface of the body, in time, assumes a greyish-blue or black colour.

Alkaline and Earthy Salts.

Certain alkaline and earthy salts, poisonous only in large doses, may conveniently be considered under this head. Cases of poisoning have been reported from large doses of the following :—

Sodium chloride, Common Salt.—This, in large doses, acts as an irritant poison. Half a pound has caused death, with symptoms of irritant poisoning followed by paralysis. **Potassium nitrate, Nitre, Saltpetre,** sal prunelle, *Sorakhara*, in doses of an ounce or more, has, in several instances, caused death. In one case, however, recovery took place after swallowing six ounces. When swallowed in poisonous doses, besides acting as an irritant, it acts remotely on the nervous system, causing great prostration of strength, and, in some cases, convulsions and partial paralysis. Suppression of urine also has been observed. In some of the fatal cases death has occurred rapidly, *e.g.* in two hours and in three hours. **Potassium chloride,** in large doses, acts as a poison, giving rise, in children, to irritant symptoms, with lividity of the surface and collapse, and in adults to nephritis. One ounce may be regarded as a fatal dose for an adult, and two drachms has caused death in children. **Acid potassium sulphate,** bisulphate of potash, sal polychrest, sal de duobus, in large doses, acts as an irritant poison; ten drachms has caused death in two hours. The salt, in some countries, is popularly believed to possess the power of causing abortion, and fatal cases have arisen from its employment with this object. It is liable to contain as impurities sulphate of zinc and arseniate of potash. Potassium bitartrate (see 'Tartaric Acid'). **Common** or **potash Alum,** *Phatki.*—This also, in large doses, acts as an irritant poison, and has, in one or two cases, caused death. Burnt alum, or alum deprived by heat of its water of crystallization, has a slight caustic action. Sulphate of magnesia, **Epsom** salts.—Christison mentions a remarkable case of poisoning by this salt. A boy, aged ten, was given by his father two ounces of Epsom salts in a teacupful of water as a laxative. The boy died of collapse within an hour; there was no vomiting or purging.

Another point of medico-legal interest attaching to this salt is the close resemblance its crystals bear to those of oxalic acid and sulphate of zinc.

Mechanical Irritants.

Under this head may be classed all substances which are liable, when swallowed, to cause symptoms of irritant poisoning, solely in consequence of their mechanical action on the parts with which they come in contact.

Many definitions of the term 'a poison' exclude such substances. As already pointed out, however, the question whether or no such substances may properly be called poisons, is for medico-legal purposes in India a matter of little importance. In India, in fact, when it is alleged that an individual has committed an offence by administering or attempting to administer one of these substances, *e.g.* pounded glass, the questions which a medical expert has to consider are: (1) What has been the effect of the administration of the substance? and (2) Is the substance one which it is 'deleterious to the human body to swallow,'[1] or an 'unwholesome thing'?[2] and not, Is the substance 'a poison'?

Substances which, when swallowed, may act as mechanical irritants, are: (1) Hard, sharp, angular or pointed solid matters, *e.g.* pounded glass, pins, and needles (see also 'Salicylic Acid,' 'Arums'), and seeds and stones of fruit; (2) Substances which swell largely by imbibition of water, *e.g.* sponge; and (3) Liquids at a high temperature, *e.g.* boiling water or melted lead. Of these, the following require special notice:—

Pounded glass.—This, in many parts of India, is popularly believed to be a very active poison, and has been used both in attempts at suicide and attempts at homicide. The Bombay Analyzer's records for the ten years ending 1884 show that during that period, this substance only was detected in thirty-one cases of alleged attempted human poisoning. In twenty-three of these it was detected in bread, sweetmeat, or some other article of food; in three more in vomited matters, two of these being cases of attempted suicide by females; in one case it was found after death in the contents of the stomach of a man (*Case* below); in another in some pills: and in the three remaining cases pounded glass, *per se*, was sent for identification. In nearly all these cases, the glass found was coloured glass, resembling fragments of bangles; and in two only it was reported that the individuals suspected of having used the

[1] *Ind. P. C.*, ss. 324, 326. [2] *Ib.*, s. 328.

glass with criminal intent were males. Five cases,[1] all from the Central Provinces, were of alleged attempted homicide, by pounded glass, all being alleged attempts by wives to poison their husbands; and Chevers[2] mentions a case brought to the notice of the Chemical Examiner, Bengal, in which a servant attempted to poison his master by pounded glass introduced into a mess of spinach, and also a Bombay case, in which a man seized in the act of committing a robbery, attempted suicide by swallowing fragments of a wine bottle.

The more finely the glass is pounded the more likely are the particles to become completely enveloped in mucus, etc., and to be thus prevented from injuring the mucous membranes. Hence, as the ill-consequences arising from swallowing pounded glass are solely due to the mechanical injury it inflicts, the more finely it is pounded the less likely is swallowing it to cause harm. Considerable quantities of pounded glass, in large angular fragments even, have often been swallowed without ill effects being produced. On the other hand, cases are recorded where swallowing pounded glass has caused symptoms of irritant poisoning (see *Cases* below), and there is reason to suppose that, in exceptional cases, swallowing pounded glass may even cause death (see *Cases* below). In Europe and America it is also employed for homicidal and suicidal purposes. By experiment Le Sauvage[3] found that $2\frac{1}{2}$ drachms of pounded glass could be given to a cat without injury, and a dog took 6 ounces in 8 days without any obvious symptoms, and Le Sauvage himself swallowed a considerable number of the particles without inconvenience following.

Case.—**Homicidal poisoning by pounded glass.**—In 1897 two cases of attempted poisoning with pounded glass occurred in Bombay during the year, namely, at the Central Jail, Yerrowda, where pounded glass was detected in a powder given to a warder in the jail, who was too zealous in detecting tobacco amongst the convicts, and in a case from Thana, where blue powdered glass was detected in the bread prepared for a man by his wife, the powder having been obtained by pounding her bangles.

Cases.—**Poisoning by pounded glass.**—(*a*) (Christison, *Poisons*, p. 654).—Portal relates a case of a man who undertook for a wager to eat his wine-glass, and actually swallowed part of it. He was attacked with acute pain in the stomach, and subsequently with convulsions. The treatment consisted in giving bulky food (cabbage) followed by an emetic. The man recovered. (*b*) (Chevers, *M. J.*, p. 288, quoted from N. Sydenham *Soc. Year Book* for 1863, p. 401).—A woman swallowed a quantity of coarsely powdered glass in order to 'scour out' her stomach. Intense pain in the stomach came on, with tenderness; the pulse became

[1] *Beng. Medico-legal Rept.*, 1870–72, p. 292. [2] *Med. Jur.*, p. 287.
[3] In Paris in 1820. *Edinb. Med. Surg. Jour.*, 1824, p. 225.

small, 100 per minute; there was thirst and pallor. An emetic was given, and the next day the urgency of the symptoms had passed off. The woman recovered.

Cases.—**Poisoning by broken glass.**—(*a*) (Christison, *Poisons*, p. 653). In a case which occurred in Paris a woman, after a hasty dinner, became unwell, and next morning was seized with violent pain in the stomach and vomiting, and died in convulsions. Forty-two days after her death her body was exhumed; black points and patches were found in the bowels, together with a quantity of broken glass. The medical witnesses differed as to the cause of death. (*b*) (*Ibid.*, p. 654).—In a case published by Mr. Hebb, a child, eleven months old, died of a few days' illness in very suspicious circumstances. On *post mortem* examination the inside of the stomach was found lined with a tough layer of mucus streaked with blood. The villous coat was highly vascular, and covered with numberless particles of glass of various sizes, some of which simply touched it, while others lacerated it. No other morbid appearance could be detected in the body. (*c*) (*Bo. Chem. Analyser's Rept.*, 1875-76).—A male adult was attacked with symptoms of irritant poisoning, and died in forty-eight hours. The mucous membrane of the stomach was found reddened, but not rugose. A quantity of powdered glass was found in contents of the stomach. No irritant substance other than pounded glass could be found in the viscera.

Treatment.—This should consist in the administration, first of bulky food so as to envelop the fragments, and then of emetics and laxatives.

Diamond dust.—Diamonds and diamond dust are popularly believed in India to be very poisonous. Thus, in the Baroda case (p. 496), a mixture of arsenious oxide and diamond dust was employed, and Chevers[1] mentions two Indian cases of attempted suicide by swallowing an unbroken diamond. Like pounded glass, any injurious action possessed by diamonds or diamond dust is solely mechanical.

Chopped hair.—This also may act as a mechanical irritant. Chevers[2] mentions that a belief exists in some parts of India that 'tiger's smellers' are poisonous, and states, on the authority of Baboo Kanny Lall Dey, that chopped hair is sometimes used by cattle poisoners. Dense concretions of felted hair are sometimes found in the intestines of ruminants. Their shape is rounded, sometimes the surface is smooth, hard, and shiny, almost spherical, and they may be a little more than an inch in diameter. They are formed from hairs swallowed by the animals when licking themselves. These concretions have occasionally been mistaken for foreign objects administered with intent to poison the animal.

[1] *Med. Jur.*, p. 289. [2] *Ibid.*, p. 291.

CHAPTER XXVI.

VEGETABLE IRRITANTS.

A LARGE number of plants yield matters capable of acting as irritant poisons. Some of these are simple irritants, possessing little or no remote specific action on the nervous system. Others are compound irritants, causing, in addition to irritation, cardiac depression, *e.g.* squills and gloriosa superba; or acting on the brain and spinal cord, *e.g.* cocculus indicus. A few owe their activity to the presence of an alkaloid or vegetable base, *e.g.* stavesacre and the veratrums; these may be called 'alkaloidal irritants.' Of the remainder, a few, *e.g.* cocculus indicus and plumbago zeylanica, contain crystalline active principles, not alkaloids. In the great majority, however, the active principle is oily or resinous in nature. The terminations *ine* and *ia* are used to denote alkaloids, *e.g.* strychnine is also called strychnia; but the British Pharmacopœia now uses *ine* exclusively. The termination *in* denotes a non-alkaloidal substance, *e.g.* picrotoxin, plumbagin.

Alkaloidal Irritants.

The detection of these and other alkaloidal poisons mainly depends on the elimination of the alkaloid, and its recognition by chemical or physiological tests. The elimination of alkaloids from organic mixtures is generally effected by a modification of **Stas-Otto** process as elaborated by Dragendorff.

Dragendorff's process for the separation of plant principles from organic mixtures is in outline as follows. The process essentially consists in—

A. **Preparing an acid watery solution** of the matters under examination, by digesting the finely divided matters with water acidulated with sulphuric acid, filtering, pressing, and twice repeating the digestion. The filtrates are mixed, evaporated to a syrup, and this is macerated for a day with four volumes of alcohol, filtered, and the residue washed with spirit. The alcohol is then driven off by evaporation from the alcoholic filtrate, water (if necessary) added, and the liquid filtered again.

B. **Extracting** this while still acid by agitation with (1) petroleum ether, (2) benzene, and (3) chloroform. The solvents are to be used in the order named, and each, after use, separately evaporated in small portions in suitable dishes. C. **Saturating the acid watery solution with ammonia** (previously removing any residual chloroform by agitation with petroleum ether) and extracting the ammoniacal fluid as in B with, in succession, (1) petroleum ether, (2) benzene, (3) chloroform, and (4) amylic alcohol; and finally (5) drying up the ammoniacal fluid by evaporation with powdered glass, and extracting the dry residue with chloroform. The table here given shows the principal substances likely to be found in the various residues. Non-poisonous substances are mentioned in brackets thus (Theine).[1]

Solvent.	B Residues from acid fluid.	C Residues from alkaline fluid.
1. Petroleum ether	Piperine, picric acid, carbolic acid, camphor, and capsicin	Liquid volatile alkaloids and aniline, also strychnine, brucia, veratria, emetine, and (quinine)
2. Benzene ..	Cantharidin, santonin, digitalin, and (thiene); elaterin, colocynthin, colchicin and absinthin	Strychnine, atropia, and hyoscyamine; also (quinine, cinchonine, and narcotine), brucia, physostigma, veratria, aconitia, and emetine
3. Chloroform ..	Picrotoxin, helleborin (cinchonine), digitalein, saponin, and jervine	Morphine (and cinchonine)
4. Amyl alcohol ..	—	Morphine, solanine, saponin, salicin
5. Chloroform ..	—	Curarine

The Stas-Otto Process for Isolating Alkaloids.

As modified by Dr. E. H. Hankin.

This 'Stas-Otto' process as elaborated by Dragendorff is, however, far too elaborate for an Indian Chemical Examiner who may have to deal with half a dozen cases of poisoning per day, and who, outside of the Presidency towns, but rarely has to test for more than a few of the common poisons.

The advice that has been given that all basins, beakers, etc., used in the test should be new, is obviously a counsel of perfection that can scarcely be carried out in practice. Sufficient protection against contamination will be obtained if care is taken that all articles used in the tests are washed in running water immediately after use. If for any reason viscera, etc., have to be left in bottles or beakers for a long time so that organic deposits are formed in their interior, it is advisable that

[1] For details of the process, see Dragendorff on Organic Analysis.

after a preliminary washing, they should be left full of water for several days. The effect of the resulting putrefactive processes is usually to loosen the deposits so that they can be readily removed. A hot solution of such soap preparations as Hudson's Extract or Lux, is often useful in the final cleaning of glass apparatus. Hot water is necessary for removing the last traces of these soap solutions from the glass.

The Stas-Otto process may be carried out as follows:—

(1) The viscera are usually received preserved in alcohol. During the time that elapses between the placing of the viscera in alcohol and their examination in the Chemical Examiner's laboratory, any alkaloids present will have commenced to pass into solution. The quantity of alcohol that has been used as preservative is usually equal in bulk to the viscera. The bottle or jar containing the viscera should be only two-thirds full. That is to say, one-third of its contents is occupied by viscera one-third by the added alcohol, and one-third remains full of air. The object of this is to avoid risk of bursting the bottle in case any gases are given off. The free space also has the advantage that the viscera are well shaken while en route, thus aiding the penetration of the alcohol.

The viscera should be cut up into small pieces, and placed in a large beaker with the alcohol in which they have been preserved.

(2) Boil the portion of the viscera destined for the Stas-Otto process in the above beaker, after the addition of a few drops of acetic acid. This is done by standing the beaker on a water-bath. In cases of suspected aconite poisoning, it is advisable not to heat the viscera above 65° C.

(3) Filter. Most of the alkaloids present are thus obtained with many impurities in a clear solution in the alcohol. The viscera remaining on the filter should be again extracted with alcohol. This second portion of alcohol should be filtered off and added to the first portion.

(4) These mixed filtrates should be evaporated nearly to dryness. The evaporation should be carried out over a water-bath in a current of air. That is to say, for this purpose, a closed stink-cupboard is not so suitable as a room attached to the building by only one side and the area of whose walls is chiefly occupied by wire gauze, and in which arrangements are made for the gas burners to be enclosed in cupboards below the level of the working benches. The wind blowing through this room is far more efficient in promoting evaporation, and removing smelling substances, than any arrangement of flues or vacuum arrangement obtainable in practice.

(5) When the above filtrate has been evaporated to syrupy

consistency, add about 20 c.c. of water, while stirring, and filter. A piece of ordinary thin filter paper and a funnel should be used for this purpose. Attempts to hasten filtration by means of a suction pump result in loss of time. In the rare cases in which the liquid refuses to filter easily, centrifuging may be employed instead of filtering.

(6) Place this watery extract in a separating funnel. Add a small piece of litmus paper. See that the reaction is acid. Should this not be the case, acidify with acetic acid. Add 50 c.c. of ether. Shake violently for one minute.

(7) Fix the separating funnel in a stand, and allow it to rest for at least an hour. By this time the ether will usually have formed a separate layer floating on the surface of the watery liquid. If the two liquids have not separated, sometimes addition of a small quantity of plaster of Paris and gentle shaking, followed by another rest, will cause separation. But a far superior method is to use a centrifuge. The small hand or electrically driven centrifuge used in bacteriological laboratories is useless for this purpose. A large and powerful centrifuge is necessary. Before placing in the centrifuge the tube containing the mixed liquids and its holder must be placed in one pan of a balance. Another tube and holder is placed in the opposite pan, and water is poured into this second holder until the two tubes balance exactly. The two holders are then placed opposite each other in the centrifuge.[1] If the two holders are not *exactly* balanced in this way undesirable and even dangerous strains are introduced. In order to be sure that the two holders are of the same weight a somewhat sensitive balance of good quality should be employed. Usually five minutes' centrifuging at full speed is sufficient. Occasionally a longer time is advisable. When the machine comes to rest, the liquids will be found to have separated. Sometimes a dense layer of glutinous matter will be found between the ether and the watery layer. This may be so dense that it is possible to invert the tube and pour off the ether without its breaking. If this is not the case, the watery and ethereal liquids must be poured gently into a separating funnel without shaking. Care must be taken to prevent the glutinous layer from passing into the separator, as if this happens

[1] To diminish the risk of the glass tubes breaking during centrifugalization it is advisable to take the following precautions: See that there is a disk or ring of rubber at the bottom of each holder on which the bottom of the tube will rest. Before placing the tube in the holder pour some water into the latter. Then the tube, when placed in the holder, will be to some extent water-borne. All tubes showing cracks or flaws should be discarded. The bearings on the centre of the spindle and at the base of the spindle of the centrifuge should be lubricated each time the machine is used.

and it becomes broken up in the liquid the two liquids will not readily separate.

(8) When the liquids have separated, hold the separating funnel with its stem in the mouth of a second separating funnel. Open the tap and allow the watery liquid to flow into the lower funnel. The ethereal layer (the acid ether extract) contains impurities, and may contain certain poisons that do not generally have to be tested for in Indian practice, and may therefore be thrown away. If the ethereal layer is strongly coloured, it is advisable again to treat the acid liquid with ether. Further washings with ether followed by repeated washings with chloroform are desirable when testing for certain poisons such, for example, as strychnine. If chloroform is used, it is best shaken with the acid liquid with the help of a shaking machine. If the above-mentioned glutinous layer has been completely removed, the chloroform should separate easily. Otherwise further centrifugalization may be required.

(9) The more common alkaloids are retained in the acid watery liquid in the lower funnel. Add to this about 2 c.c. of chloroform and a piece of litmus paper. Then add 50 c.c. of ether. Shake. Add sufficient ammonia to change the reaction to alkaline. Then, at once, shake violently for at least half a minute. The reason for shaking at once after the addition of the ammonia is that at the moment of liberation by ammonia the alkaloids present are in a condition in which they can, in most cases, pass readily into the chloroform ether mixture. After the lapse of a few minutes they become changed and pass into solution in the ether less easily.

(10) Place the separating funnel in a stand. Allow it to rest for some time, preferably till next day. In rare cases it may be necessary to centrifugalize.

(11) The liquid will now have separated into two layers. The upper ethereal layer contains most of the alkaloids. This is called the 'alkaline ether extract.' The lower watery layer contains impurities, and in cases of opium poisoning will contain morphia and the substance giving the 'meconic reaction.'

(12) Tap off the watery liquid. See that the piece of litmus paper in the separating funnel is blue.

(13) Pour off the ethereal liquid through the mouth of the funnel into a porcelain basin. If traces of the watery liquid come with the ether they will soon settle to the bottom of the porcelain basin, and in this case the ether must be poured from the first into a second basin in order to leave these watery impurities behind.

(14) Add to the ether in the basin a few drops of a $\frac{1}{2}$ per cent. solution of acetic acid in water.

(15) Evaporate on a water-bath, preferably under a small rotary fan, until only two or three drops of the dilute acid are left. It is preferable (especially in cases of aconite poisoning) that the water-bath should be heated to something less than the boiling point, and allowed to cool further as evaporation proceeds. The evaporated dilute acid may now be tested for different alkaloids.

(16) The watery liquid of (11) is now made acid and heated. While hot an equal volume of amyl alcohol is added. The liquid is made alkaline with ammonia, and the mixed liquids are violently shaken. Morphia, if present, passes into the amyl alcohol.

(17) The watery liquid separated from (16) may now be subjected to the meconic test.

Special Alkaloidal Irritants.

The chief alkaloidal irritants are Stavesacre, Aconite, Sabadilla, Hellebore, Colchicum, Laburnum, Emetine, and Apomorphia.

Ranunculaceæ.

Stavesacre.—*Delphinium Staphysagria.*—The seeds of this plant have an acrid taste, and from experiments on animals have been ascertained to act as a compound irritant poison, their special remote action being to cause cardiac depression, and paralysis of the respiratory movements. They contain several alkaloids, of which the two most important are staphisagrine, which paralyzes the motor nerves like curare; and delphinine, which appears to act very similarly to aconitine, paralyzing both the spinal cord and the heart. For other poisons belonging to this order, see 'Non-alkaloidal Irritants' and 'Aconite' (see 'Cardiac Poisons,' Chap. XXX.).

Melanthaceæ.

Cevadilla or **Sabadilla**—*Asagræa officinalis*, *Veratrum officinale*, *Sabadilla officinarum* or *Schœncraulon officinale.*—From the fruit and seeds of this plant the poisonous alkaloid, or mixture of alkaloids, used in medicine under the name of veratria or *veratrine*,[1] is obtained. This is an active poison. The medicinal dose is one-twelfth to one-eighth of a grain. In over-doses it causes violent sneezing, and the usual symptoms of irritant poisoning coupled with great depression of the action of the heart and collapse. Veratria also first stimulates and then paralyses the peripheral extremities of the sensory nerves; hence a peculiar pricking sensation followed by numbness is one of the symptoms of poisoning by it. In cases of poisoning by veratria, this pricking and numbing sensation is said to be more felt in the fingers and toes and in the joints than in the tongue; while in cases of poisoning by aconite,

[1] Commércial veratrine has lately been found to consist mainly of two alkaloids, veratrine and cevadine, both powerfully sternutatory.

which has a similar effect on the sensory nerves, the pricking and numbing sensation is more felt in the tongue. The seeds contain about 0·3 per cent. of veratria. Detection.—Veratria may be extracted from organic mixtures by Stas' process, and recognized by the following special tests: (1) It excites violent sneezing. (2) Strong hydrochloric acid dissolves it without change of colour, but on warming the liquid becomes red. (3) Strong sulphuric acid dissolves it, forming a yellow solution, which gradually changes to orange and finally becomes red; on the addition of bromine water to the sulphuric acid solution, a purple colour is produced.

White hellebore, or *Veratrum album*, and *Veratrum viride*, American or *green hellebore*. The rhizomes or root-stocks of these, and of other species of veratrum, cause symptoms similar to those caused by veratria. Twenty grains of white hellebore root has caused death, and probably less would prove fatal. Green hellebore root, officinal B.P. and I.P., is less irritant than white hellebore and rarely occasions purging; except this, its action is similar to that of white hellebore root. The medicinal dose of green hellebore root is 1 to 2 grains. Formerly, the veratrums were believed to owe that activity to the same principles as sabadilla. Later, however, it has been found that they contain the alkaloids of sabadilla in small quantity only, and that the alkaloids present in them are chiefly jervine, pseudo-jervine, rubi-jervine, and veratralbine, all non-sternutatory bases. All four give a play of colours with strong sulphuric acid, the two last giving colours very similar to veratria, while jervine and pseudo-jervine give a yellow changing to yellow-brown, and after a time to green, the green tint becoming more developed on dilution.

Colchicum autumnale, or *Meadow Saffron*.—The whole of this plant, a native of Europe, is poisonous, owing to the presence of colchicine, a nitrogenous substance classed by some chemists as an alkaloid. The corm and seeds are used in medicine chiefly in the treatment of gout, and are a constituent of quack remedies for gout. In over-doses, colchicum causes burning pain in the throat and abdomen, violent vomiting and purging, and the usual symptoms of irritant poisoning, coupled with great collapse. The brain, as a rule, is unaffected. In fatal cases death usually occurs within twenty-four hours. *Post mortem appearances.*—After death the stomach and intestines are usually found inflamed, though this may be absent. In exceptional cases, however, *post mortem* appearances of irritation of the alimentary canal have been altogether absent. Colchicum is seldom used criminally as a poison. **Dose.**—The medicinal dose of the powdered corm is 2 to 8 grains. The B.P. and I.P. in addition contain an extract, and an acetic extract of the corm, dose ½ to 2 grains; also a wine prepared from the corm (strength 1 to 5), and a tincture of the seeds (strength 1 to 8), dose of either 10 to 30 minims. In two cases a quantity of tincture equal to 48 grains of the dried corm caused death. This is the smallest fatal dose on record. More than one case of recovery after swallowing one ounce of the wine has been reported. **Treatment.**—The general treatment of irritant poisoning, with free administration of decoctions containing tannin. Stimulants in form of brandy by the mouth (or if vomiting is present ether injections) should be given to counteract depression, and the patient kept warm. **Detection.**—The fresh corm is pear-shaped, about 2 inches long by 1 inch or rather more in width; brown externally, white, firm, and starchy within. When cut it exudes a milky juice, its taste is bitter and acrid. The seeds are reddish-brown externally, white within, spherical, and about one-tenth

of an inch in diameter. For the separation of colchicine from originic mixtures, Stas' process may be employed, using chloroform as a solvent. Colchicine differs from alkaloids, in being removed from acidulated watery solution by agitation with chloroform; hence the acid watery filtrate obtained in Stas' process may first be shaken with petroleum ether, in which colchicine is insoluble, to remove impurities, and then without neutralization with chloroform. Colchicine, unlike alkaloids also, is not precipitated by mercuric potassic iodide solution. The special chemical test for colchicine is Zeïsels'; when a dilute solution of colchicine is boiled with ferric chloride it becomes green, sometimes dark green and cloudy, and if the fluid be then agitated with chloroform the chloroform will sink, taking with it the colouring matter and appearing brownish granite red or dark, while the supernatant fluid clears up without becoming wholly colourless. A readier test is the reddish-violet colour produced by the action of strong nitric acid upon it. It does not, like veratria, excite sneezing. The physiological test is not trustworthy for colchicine, a French committee of experts concluded that "experiments on animals do not afford the means of determining that poisoning by colchicine has taken place." Ogier obtained the reactions of colchicine isolated by the usual process from the exhumed bodies of dogs which he had poisoned with it five and a half months before. In the bodies of animals poisoned with it, Obolonski detected colchicine four and a half months after death.[1]

Hermodactyl, *Surinjan.*—Under the name of *surinjan* two kinds of *hermodactyl* are sold in the bazaars of India, *súrinján-i-shirin* or tasteless hermodactyl, and *súrinján-i-talkh* or bitter hermodactyl. Both varieties of hermodactyl are corms, more or less resembling colchicum corms. Of the two the tasteless variety appears to be nearly inert, while the bitter variety acts like colchicum, though doubtfully poisonous. It is the corm of *Colchicum luteum*, growing in Cashmere; and the sweet variety, the corm of *Merendera persica*. Dymock[2] notes that the sliced bulb of the true narcissus (*N. Tazetta*) is sold in Bombay as bitter Surinjan, but that it may be detected by its larger size and tunicated structure. Its action is similar to that of other species of narcissus (see *Amaryllideæ*).

Leguminosæ.

There are several poisonous peas in India. **(Laburnum)** *Cytisus Laburnum.*—All parts of this plant, common in Europe, are poisonous. Several cases of poisoning by it, mostly accidental, have occurred in England. The usual symptoms of laburnum poisoning are vomiting and purging, followed by drowsiness and insensibility, with muscular twitchings and dilated pupils. Its active principle is the alkaloid cytisine. Cytisine is said to be the active constituent of Persian and Australian insect powder. **Broom.**—*Cytisus scoparius vel Spartium scoparium.*—The tops of this plant, also a native of Europe, are official in the B.P. and I.P. In large doses they cause vomiting and purging. They contain a crystalline non-poisonous substance, scoparin, and the poisonous liquid volatile alkaloid sparteine, the action of which is identical with that of conia, a similar alkaloid contained in conium maculatum, which see.

[1] Dixon Mann, *For. Med.*, 619. [2] *Mat. Med.*, p. 837.

Other Irritant Alkaloids.

Emetine.—This is the alkaloidal active principle of ipecacuanha, and is an irritant to the gastric mucous membrane, rapidly causing vomiting; it is also a cardiac depressant. **Apomorphine.**—This is an artificial alkaloid, prepared by heating morphine with hydrochloric acid. It is the most active emetic known; one-tenth to one-quarter of a grain of the hydrochloride of apomorphine by the mouth or one-twentieth grain to one-tenth grain hypodermically injected, rapidly causes free vomiting, and may be employed to excite vomiting in cases of poisoning, especially where the gullet is obstructed.

In cases of poisoning by the alkaloidal irritants (and by alkaloids generally) administration is indicated of gallic acid, or tannin or decoctions containing tannin. These form insoluble compounds with alkaloids. Or animal charcoal, which removes alkaloids from solution by adhesion, may be given with a similar object.

Non-Alkaloidal Vegetable Irritants.

The great majority of these do not contain any substance capable of detection by chemical processes. Hence, many can only be recognized by their botanical or physical characters. A few, however, contain matters separable from organic mixtures by chemical processes and capable of identification by chemical or physiological tests. When such matter is a *glucoside* or other crystalline substance, its separation may, in many cases, be effected by a modification of the process for elimination of alkaloid just described. This essentially consists in extracting with immiscible solvents, *e.g.* ether, benzene, etc., the unneutralized instead of the neutralized acid watery filtrate (see 'Picrotoxin' and 'Plumbagin').

Anacardiaceæ.

Marking-nuts, *Bhela, Bhilawa* (Hind.), *Bibba* (Bomb.), *Shen-kottai, Sherankottai* (Tam.), the fruit of the Semecarpus *Anacardium.* Marking-nuts appear to be seldom, if ever, in India, given internally as a poison. The bruised nut, however, is used as a local irritant application for the purpose of procuring abortion; and the juice, like vitriol in England, is thrown over the body to cause injury. A case of this last kind

terminating fatally, where marking-nut juice mixed with other irritants was employed, is recorded.[1] Again, in a case tried before the High Court, Bombay, a Hindoo was convicted of causing hurt to his wife by throwing marking-nut juice over her face, blistering of the skin and severe ophthalmia of one eye, lasting several days, being the result. Marking-nut juice is also used by malingerers for the purpose of producing ophthalmia and skin eruptions; and Dr. W. Gray once met with a case where a man introduced three marking-nuts into his wife's vagina, apparently as a punishment for infidelity.

FIG. 31.—Marking-nuts.

The juice, more or less diluted, is said to be used as an application to the skin for the purpose of imitating bruises in support of a false charge.[2]

IDENTIFICATION.—Marking-nuts, in the dry condition in which they are usually met with, are black in colour and more or less heart-shaped, with a rough projection at the base (see Fig. 31). They measure, excluding this projection, in longest diameter from about 7 to 11-tenths of an inch, and weigh from about 25 to 55 grains each. They have a thick cellular pericarp, the cells of which contain the irritant juice. Inside the pericarp is a large flat non-acrid kernel. An acrid juice similar to that found in the pericarp is contained in the thick root bark of the tree. The acrid juice is soluble in alcohol, ether, and oils. It contains anacardic acid and cardol. Although both these substances are readily decomposed by heat, irritant effects have been produced by exposure to the vapour of the juice. Anacardic acid may be extracted from the juice as an insoluble lead salt, by digesting an alcoholic solution with oxide of lead. Water added to the alcoholic solution after removal of the anacardic acid, causes separation of the cardol. Cardol is a yellow, oily liquid, insoluble in water, but soluble in alcohol and ether. It blisters the skin strongly, and, according to Basiner, when subcutaneously injected in large doses, causes, in warm-blooded animals, stupor and paralysis. Marking-nut juice may be recognized by (1) its solubility in alcohol, ether, and oils; (2) its vesicating action on the skin; and (3) if a few drops of an alcoholic

[1] Basiner, quoted by Dymock, *Mat. Med.*, 2nd ed., p. 204.
[2] *Op. cit.*, p. 203.

solution of the juice are placed in a porcelain dish, and a drop of solution of potassic hydrate is added thereto, a bright green colour is at once produced, which, on rolling the fluid about in the dish, rapidly changes to reddish-brown. When applied to the skin it should be diluted with oil, and used with caution. When applied diluted it may be some time before it begins to act. Testing in this way some of the fluid used in the Bombay case mentioned above, no effect was noticed for forty-eight hours, after which a painful and very persistent eruption was produced.

The fruits when bruised yield a brown, highly acrid, oily juice, turning black on exposure to the air. This juice, when applied to the skin, vesicates strongly, raising black blisters, containing a fluid which causes an eczematous eruption on any part of the skin it comes into contact with. Internally administered, the juice appears to be much less actively irritant than it is when externally applied. According to Dymock,[1] the juice of one nut mixed with a seer of milk is an ordinary internally administered dose in native medical practice; and Mohammedan writers speak of 12 to 24 grains of the juice, given in oil or melted butter, as an ordinary medicinal dose, and of 2 dirhems (= 96 grains) as a poisonous dose.

Cashew-nuts, *Kaju* (Hind., Mar., Bomb.), *Kottai-mundiri* (Tam.), *Hijli-badam* (Beng.); the fruit of *Anacar dium occidentale*.—The pericarp of the Cashew-nut contains a brown acrid juice of similar composition and properties to marking-nut juice. Its alcoholic solution, however, treated with potassic hydrate solution, turns reddish-brown, and not bright green, like an alcoholic solution of marking-nut juice. Cashew-nut juice appears to be seldom, if ever, used criminally in India. The kernel of the nut is non-acrid, and is eaten raw, or more usually slightly roasted, or cooked.

Rhus.—Some species of this genus of Anacardiaceæ yield a milky juice possessing irritant properties, very similar to those of marking-nut juice. Exposure simply to the vapour of this juice is said to cause distressing symptoms. Woodman and Tidy[2] mention as poisonous—*Rhus radicans*, poison-oak or poison-ivy; *Rhus vernix*, poison-Sumach; and *Rhus toxicodendron*. Among the plants of Sind, Murray[3] mentions as yielding a similar acrid juice, *Rhus acuminata* (syn. *Rhus succedanea*, Linn.), *Tatree* (Hind.), *Arkkol rikul* (Panj.). Regarding *R. Toxicodendron* and other species see:—J. C. White's *Dermatitis Venenata*, 1887 (the American journals frequently contain reports on cases); Morrow's *Drug Eruptions* (Syd. Soc. Ed.); Albert Billet on Dermatitis from Varnish Sumach in Annamite Soldiers (extracted *Brit. Journ. Dermat.*, November 18th, 1896, p. 456); McCartney (The *China Med. Missy. Journ.*, vol. viii. No. 2, June, 1894); also Mathews in September number; Nicholson of Kew Royal Gardens has known several cases. Several

[1] Dymock, *op. cit.*, p. 203, and *Ind. Med. Gaz.*, Aug., 1900.
[2] *For. Med.*, p. 282.
[3] *Plants of Sind*, p. 86.

species give rise to acute inflammation of the skin, the so-called *dermatitis venenata*. The itching and burning and inflammation may be alleviated by saturated solution of boric acid or sedatives.

Oleaceæ.

Wild olives possess an irritant principle which has proved to be poisonous.

Case.—**Wild olive** poisoning.—The Civil Medical Officer of Kurseong sent some wild olives preserved in lime-juice, which a Eurasian boy, fifteen years old, belonging to the Victoria School at Kurseong, ate on the 15th November. The boy was taken ill on the 16th with acute vomiting, and died on the 17th. Other boys were reported to have eaten the same olives without ill effects. The olives were found to possess irritant properties. A small quantity of the extract of the olives was administered to a cat. The animal vomited several times, but ultimately recovered. The nature of the irritant principle could not be determined. —C. L. Bose, *Beng. Ch. Ex. Rept.*, 1907.

Asclepiadeæ.

Madar.—*Calotropis gigantea*, Brown (*vel Asclepias gigantea*, Willd.), *C. procera*, Brown (*C. Hamiltonii*, Wight), *Ak*, *Madar* (Hind.), *Akanda* (Beng.), *Akra*, *Rui* (Bomb.), *Erukku*, *Erukam* (Tam.). These two shrubs closely resemble one another, and are known by the same vernacular names. One or other of them is found growing wild almost everywhere in India. The leaves and stalks, when incised, yield an acrid milky juice, used in native medicine as an external application in cutaneous affections and as a depilatory. The fresh or dried juice, or the root bark, is also given internally as an alterative or purgative. An ordinary medicinal dose of the powdered root bark as an alterative is 3 to 10 grains three times a day. In doses of 30 to 60 grains the root bark acts as an emetic, and has been used as a substitute for ipecacuanha.

In India *madár* juice appears to be used criminally, chiefly for purposes of infanticide, and as an abortifacient, more rarely for suicide and still more rarely for homicide. According to Chevers and others, forcing *madár* juice down the throat is the method of infanticide employed by the castes among which female infanticide prevails. *Madár* juice is also given internally, and applied locally, for the purpose of causing abortion. The leaves have also been administered for criminal purposes with food. It is also used as a cattle poison.

The active principle appears[1] to be a yellow bitter resin, besides which the root-bark also contains two substances named

[1] Warden and Waddell in *Pharm. Journ.*, August 22, 1885.

by Warden and Waddell,[1] 'madár-alban' and 'madár-fluavil,' closely resembling the alban and fluavil found in gutta-percha. It contains no alkaloid.

Cases.—**As Infant Poison.**—The Civil Surgeon, Ludhiana, forwarded the viscera of a female infant, aged 3 days, said to have been poisoned by the mother, after a quarrel with her mother-in-law. The juice of *madár* (*Calotropis gigantea*) and opium were found in the child's stomach.—Maj. Black, *Panjab Chem., Ex. Rept.*, 1916. See also *Case* at p. 351.

Fig. 32.—Calotropis gigantea—Stem, Leaf, and Flower ½.

Case.—**Cattle Poisoning by madár.**—In 1896 a piece of cloth, stiffened with a sticky substance alleged to be *madár* juice and taken from the stomach of a cow, was sent for examination. An alcoholic extract of the rag was given to a cat, which died within half an hour. The symptoms noticed were:—Vomiting, profuse salivation, severe tetanic convulsions, extremely slow and stertorous breathing and dilation of the pupils.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

[1] Warden and Waddell in *Pharm. Journ.*, August 22, 1885.

Identification.—The root bark (officinal I. addn. to B.P.) occurs in short, flat or arched pieces $\frac{1}{8}$th to $\frac{1}{3}$th of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured lengthwise, and can be easily separated from the middle cortical layer, which is white, mealy, and traversed by narrow brown liber rays. The taste is mucilaginous, bitter and acrid, and the odour peculiar (Dymock). Figs. 32 and 33 show the general appearance of the root, leaves, flowers, etc., of *C. gigantea*. Drury describes the flowers of *C. gigantea* as rose-colour and purple mixed, and those of *C. procera* as pale purple.

Fig. 33.—Calotropis gigantea—Root $\frac{1}{2}$.

Cryptostegia grandiflora, Syn. *Nerium grandiflorum* (see Fig. 34).—This is a climbing plant belonging to the N.O. *Asclepiadeæ*. The stalk yields a milky juice, which, when dried, solidifies into a substance resembling india-rubber. One fatal case of poisoning by this plant has been reported as follows:—

Case.—**Poisoning by Nerium grandiflora.**—The pounded leaves mixed with water were swallowed. Persisting vomiting came on half an hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present. No alkaloid could be found in the leaves.

Tylophora fasciculata, vern. *Bhui-dori* (see Fig. 35).—This plant is abundant in the Southern Konkan, where it is used as a rat poison. One homicidal case of poisoning by administration of the pounded roots in

food has been reported (see below). From the symptoms stated to have been present in this case, viz. tingling in the mouth, dryness of the throat, giddiness, loss of power over the extremities, and insensibility with dilated pupils, the poison appears to be narcotico-irritant in its action.

Case.—**Tylophora fasciculata poisoning.**—Asst.-Surgeon Narayen Ananta, in charge of Pandharpur dispensary, reported in April, 1880, the following case: A Mohammedan family, consisting of six adults and a servant boy *æt.* about fourteen, were attacked soon after a meal with symptoms of poisoning. The servant boy died in about two hours. The others were seen the next morning, when they complained of dryness of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated

FIG. 34.—Nerium grandiflorum *vel* Cryptostegia grandiflora.

that soon after taking their mid-day meal on the previous day they felt some tingling sensation in the mouth, followed by dryness of the tongue and throat and giddiness, and loss of power over the extremities. After this they became insensible. Three of them vomited and recovered consciousness at about 8 P.M.; the other three remained insensible till midnight. On *post mortem* examination of the body of the boy, the following appearances were noted:—Face bloated, tongue and eyes slightly protruding, veins of the neck turgid. Lungs engorged; right side of the heart full, left empty. Slight congestion of the pia mater. A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, was at enmity with the persons poisoned, and asked a friend to recommend him something to kill rats with. The friend advised him to use bhui-doree. On this accused, it

was reported, obtained some bhui-doree roots, and having reduced them to powder mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared.

Tylophora asthmatica, Wright and Arnott, *Antamūl Jangli pikwān.*—This plant, used as an emetic in India, caused three fatal cases of poisoning in Madras in 1898 (see *Case* below). An alkaloid named tylophorine was extracted by Dr. Van Gezel.

Fig. 35.—Tylophora fasciculata.

Cases.—A young man, suffering from gonorrhœa, took the juice of this plant about 10 P.M., and died next morning with slight convulsions of upper extremities and unconsciousness. A man and his wife were given this plant by a native quack doctor also as a cure for gonorrhœa. At 7 P.M., three hours after, both complained of acrid feeling in mouth and throat followed by nausea, vomiting, purging, collapse and death next day. In both cases the alkaloid *tylophorine* was extracted from the viscera. The accused native doctor was sentenced to 18 months' rigorous imprisonment. His defence was that three days' doses had been taken all at once.—*Mad. Chem. Ex. Rept.*, 1898.

Convolvulaceæ.

Kala-dana seeds.—*Kálá-dánah*, *Mirchai* (Hind., Beng., and Bomb.), *Kodi kakkatan-virai* (Tam.); the seeds of *Ipomœa hederacea v. cœrulea*. These are used in India as a substitute for jalap, the medicinal dose being 30 to 50 grains of the powdered seeds. The active principle is a resin considered by Flückiger and Hanbury to be identical with convolvulin. No case of poisoning by these seeds has been reported, but in large doses the powdered seeds would doubtless give rise to symptoms of irritant poisoning. IDENTIFICATION.—Dymock gives the following description of the seeds: "The seeds resemble in shape those of most of the convolvuli, being in the form of a segment of a sphere; they are generally about $\frac{3}{16}$ of an inch in length, and nearly as much in breadth, but sometimes much smaller. Their weight varies from $\frac{1}{2}$ to nearly 1 grain; the colour of the testa is black, except at the umbilicus, where it is brown. Upon soaking the seeds in water the testa bursts and discloses the delicate albumen which envelops the folded cotyledons and radicle. These have an acrid taste and earthy odour." The same author notices that in Bombay the seeds of *Ipomœa muricata* are more common than those of the true kala-dana. These are similar in action and appearance to true kala-dana seeds, except that they are larger and heavier, weighing about 3 grains each, and are rather lighter in colour.

Cucurbitaceæ.

Elaterium.—This is the sediment from the expressed juice of the *Ecbalium elaterium* (*syn. E. officinarium*), or squirting cucumber. It is a powerful cathartic, and is used in medicine as a purgative in doses of one-sixteenth to half a grain. One grain has caused severe symptoms, and probably but little more would be required to cause death. The active principle is elaterin, a white crystalline substance obtainable by adding ether to a chloroform solution of elaterium; elaterin is soluble in alcohol, and not precipitated from its alcoholic solution by tannin.[1] Dymock notices that the fruit of this plant, or of a closely allied species, is sold in the Bombay shops under the name of *Kateriindrayán*.[2] IDENTIFICATION.—The fruit is $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, oblong ovoid, pale yellowish-green, and covered with numerous short fleshy prickles, terminating in white elongated points. When ripe it separates suddenly from the stalk, violently expelling the juice and seeds.

Cuscuta reflexa, *Akasweli*, *Ghagarbel* (see Fig. 36).—This is a parasitic plant with white bell-shaped flowers, common on bushes in some parts of India. According to Asst.-Surgn. Dulip Singh,[3] the *dhais* (nurses) in the Panjab have great faith in a decoction of this plant as an abortifacient. A decoction of 180 grains of the plant, made with boiling water, suffices, it is stated, to produce depression with nausea and vomiting, followed by abortion.

Citrullus colocynthis—*Indrayan* (Hind.), *Peykomatti Tumat* (Tam.), *Kururundawan* (Mar.).—The colocynth of the pharmacopœias, used in medicine as a purgative in doses of from 2 to 8 grains, is the dried and powdered fruit pulp of this plant. In large doses it acts as an irritant poison, and has in Europe in several instances caused death. Christison[4] mentions a case where a teaspoonful and a half of the powder (about 90

[1] *Pharmacographia*, p. 262.
[2] *Mat. Med.*, p. 352.
[3] *Ind. Med. Gaz.*, January, 1885.
[4] *Poisons*, p. 595.

grains) proved fatal, and Taylor [1] cites the case of an adult female who took 120 grains of the powder in order to cause abortion, and died in fifty hours. A case of recovery from a dose of 3 ounces is, however, reported. The active principle is a glucoside colocynthin. In India both the fruit pulp and the root are used in native medicine as purgatives. IDENTIFICATION.—The dried fruit of Indian colocynth is yellow-brown in colour, and about the size and shape of an orange. It contains a scanty greyish-white pulp, in which are a number of brown seeds.[2] "The root is fibrous, tough, and stringy, and of a yellowish-white colour. All parts of the plant are very bitter, and the dust when dry very irritating to the eyes and nostrils" (Dymock).

FIG. 36.—Cuscuta reflexa.

Other Cucurbitaceae.—Many other plants of this order possess properties more or less resembling those of the three just mentioned. Some, it is true, yield edible fruits, but "there is reason to believe that some if not all the edible sorts of gourds owe their freedom from poisonous properties to cultivation, for some in a wild state are found to possess them in much activity." [3] The principal Indian species mentioned by different writers as being either in common use as purgatives, or as having given

[1] *Poisons*, p. 522.

[2] These are of flattened ovoid form, measure two-tenths by three-tenths of an inch, and are disposed in vertical rows on three thick parietal placentæ, which project to the centre of the fruit, then divide and turn back, forming two branches directed towards one another (Dymock, p. 337).

[3] Lindley, quoted by Birdwood, *Bo. Veg. Prod.*, p. 157.

rise to cases of poisoning, are as follows:—The bottle-gourd, *Lagenaria vulgaris.—Tumbi, Karwi-tumb* (Hind.), *Tiktalau* (Beng.), *Karwa-bopla* (Bo.), *Shora-kai* (Tam.), *Hurrea-kuddoo* (Duk.), *Anapakai* (Tel.).—The fruit of the wild variety of this is bitter and powerfully emetic and purgative. The wild variety, dried, is made into musical instruments, bottles, etc., and it is stated that some sailors were once poisoned by drinking beer which had been standing in a bottle made from one of these gourds.[1] *Citrullus amarus.*—This is the wild form of the *C. vulgaris*, or 'water-melon.' The fruit is very bitter, and is used medicinally as a purgative. The dried fruits are sold in bazaars of Sind under the name of *kirbut.*[2] Common cucumber—*Cucumis sativus.*—The fruit of the wild form of this, also called *C. Hardwickii*, vern. *Pahari indrayan*,

FIG. 37.—Momordica cymbalaria.

is said to possess properties similar to those of the officinal colocynth. *Cucumis trigonus* (syn. *C. pseudo-colocynthis*), *Karit* (Dymock), *Indrayan, Bislumbhi* (Phar. of Ind.).—This has bitter fruit of the size and shape of a small egg. The fruit is used as a substitute for colocynth. In 1883 a case was reported to the Bombay Chemical Analyzer's Office, in which it was stated that the roots of this plant had been administered for the purpose of procuring abortion. A variety, *C. trigonus*, var. *pubescens, Takmaki*, is much less bitter, and is used as a vegetable.

[1] Lindley, quoted by Birdwood, *Bo. Veg. Prod.*, p. 157.
[2] Murray's *Plants of Sind*, p. 41.

Trichosanthes dioica, *Pulbul, Potole.*—K. L. Dey [1] states, with reference to this plant, "The bulbous part of the root is a hydragogue cathartic." This plant is cultivated in Bengal and Guzerat for its fruit, which is used as an article of food. An alcoholic extract of the unripe fruit, in three to five grain doses, is described as a powerful cathartic.[2] *T. cucumerina, Kadu-padavala* or *Ranpadavala* (Mar.), has similar medicinal properties, and is the Patola of Bombay; it is not cultivated and the fruit is never eaten. Similar properties appear also to be possessed by *T. palmata, Lal-indrayan* (Hind.), *Kaundal* (Bomb.), *Mákál* (Beng.), *Koratti, Shavaripazhan* (Tam.), the fruit of which, Dr. Kirtikar informs me, is sometimes used as a cattle-poison.

FIG. 38.—Momordica charantia.

Momordica cymbalaria (syn. *Luffa tuberosa*), *Kadavanchi* (Mar.) (see Fig. 37).—Dymock, in regard to this, writes: "The whole plant is acrid. The fruit is about 1 inch by $1\frac{1}{4}$ inch, has eight prominent ribs, is covered with silky hairs, and while still green dehisces into four parts, discharging its seeds." The roots are tuberous and ovoid. Three cases in the last few years have been reported to the Bombay Chem. Analyzer, in which it was stated that abortion had been caused by the administration of a decoction of these roots

Momordica charantia, *Karela* (Hind.), *Kárlá* (Bomb.), *Pava-kai* (Tam.), (see Fig. 38).—The fruit of this is bitter, but wholesome. It is

[1] *Drugs of India*, p. 118. [2] *Beng. Disp.*, p. 351.

eaten, but requires to be steeped in salt water before being cooked. A case was reported to me in 1879, in which it was stated that swallowing a decoction of the roots of this plant caused abortion at the seventh month.[1]

Luffa acutangula, var. amara, *Karvi-turai* (Hind.), *Kadu-sirola, Kadu-dorka* (Bomb.), *Ghosha-lata* (Beng.), *Sendubir-kai* (Tel.)—Dymock describes the fruit as smooth, 3 inches to 5 inches long, ovoid, marked with ten prominent sharp longitudinal ridges, and having at the apex a

FIG. 39.—Luffa echinata.

small operculum rather more than $\frac{1}{2}$-inch in diameter, which is deciduous. The seeds are grey, and marked with small, irregular, black, prominent specks. Sakharam Arjun [2] describes the fruit as violently cathartic and emetic.

Modecca palmata.—In Madras a girl ate some of the fruit of this gourd, and was attacked by severe irritant symptoms and died a week after.[3]

Luffa echinata, *Kukar-wel, Deodangri* (see Fig. 39).—The fruit of this

[1] *Bo. Chem. Analyser's Rept.*, 1879–80. [2] *Bo. Drugs*, p. 59.
[3] *Trans. Bo. Med. and Phys. Soc.*, 1887.

is described by Dymock as "oval, about the size of a nutmeg, armed with numerous long rather soft diverging bristles, obscurely divided into three cells, by numerous dry fibres, and opening at the top with a perforated stopple, which falls off when the seeds are ripe. Seeds about eighteen (ovate, compressed, black and scabrous), testa very hard, kernal white." The fruit of this is also stated by Sakharam Artun to possess purgative properties.[1]

Euphorbiceæ.

The Euphorbias all yield an acrid milky juice possessing properties similar to those possessed by the juice of *E. resinifera*,

Fig. 40.—Euphorbia rothiana.

and probably also possessing the same chemical composition.[2] Various writers mention the following Indian species as plants the juice of which is employed in native practice, externally as caustic or vesicant, or internally as a purge. Occasionally,

[1] *Mad. Chem. Ex. Rept.*, 1898, and Dr. Warden, *Pharm. Jour.*, 1890, p. 997.
[2] Flückiger has also found euphorbon in *E. Tirucalli* and *E. cattimaudoo*.

also, the juice of one of the euphorbias, or a twig of one of them, is used as a local irritant application for the purpose of causing abortion; or homicide is attempted by mixing the juice with food.

Euphorbium, or 'Gum Euphorbium,' vern. *Farfiyun*, is the dried milky juice obtained by incising the fleshy branches of *Euphorbia resinifera*, a leafless perennial plant resembling a cactus, growing only in Morocco. It is used in Europe in veterinary practice as a vesicant. Applied to the skin it causes irritation and vesication, and when swallowed is an extremely active irritant poison. A teaspoonful given to an adult in mistake for rhubarb caused death in three days. Inhalation of the dust raised in grinding euphorbium is reported to have caused headache, giddiness and stupor.[1] Flückiger found euphorbium to owe its acrid

FIG. 41.—Corollacarpus epigæa.

properties to an amorphous neutral resin readily soluble in cold spirits of wine. Of this 38 per cent. was present in the sample examined. In addition, the sample contained 22 per cent. of *euphorbon*, a crystalline substance, sparingly soluble in cold but freely soluble in boiling alcohol, and soluble also in ether. The remaining 40 per cent. was made up of mucilage, malates, and mineral compounds. If euphorbon, deposited from solution in alcohol in a thin film, is moistened with oil of vitrol, and strong nitric acid be slowly added by means of a glass rod, a fine

[1] Christison, *Poisons*, p. 589.

violet hue appears.[1] Lactucerin, contained in Lactucarium, gives, however the same reaction.

Euphorbia tirucalli, Milk hedge. *Thor nival* (Bomb.); *Kali* (Tam.); *Tirucalli* (Mal.); *Lunkasij* (Beng.).—Dymock mentions that one to four drops of the juice of this are given as a purge.

Euphorbia neriifolia, *Sehund*, *Thohar* (Hind.), *Mansasij* (Beng.), *Newarang*, *Mingui* (Bo.), *Ilaik kalli* (Tam.).—Ainslie, quoted by Dymock, states that the usual dose of the juice of this plant, given by native practitioners as a purge, is about twenty grains.

Euphorbia antiquorum, *Schadida-calli* (Mal.), *Shadray Kullie* (Tam.), *Bontajammoodoo* (Tel.), *Narashij*, *Seyard* (Hind.), *Narsij* (Beng.), (Drury). —Dymock also mentions *E. pilulifera*, *E. thymifolia*, and *E. parviflora*, all three known in the Southern Concan under the name of Nayeti.[2] Drury refers to the use as a vesicant of the fresh juice of *E. cattimandoo*:[3] and W. Gray[4] mentions a case in which the juice of *E. rothiana* (see Fig. 40) was administered internally to a sick man, who shortly afterwards died, but whether from the disease or the effects of the medicine, could not be made out from the particulars furnished of the case.

Corollacarpus epigaea (*syn. Bryonia epigœa*), *Rakasgaddah*, *Akasgaddah* (Hind.), *Karwi-nai* (Bo.), *Akasha-garudan* (Tam.) (see Fig. 41). —The root of this plant contains a yellow bitter principle, which, Dymock suggests, may possibly prove to be identical with bryonin. The root is used, in doses of about one drachm in twenty-four hours, as a purgative.

Croton seeds and oil.—*Croton Tiglium.*—*Jamálgota* (Hind. and Bomb.); *Jaipal* (Beng.); *Nervalam* (Tam.), *Naypalum* (Tel.), *Cadelavancu*, *Neervaula* (Mal.).—Both the seeds of this plant, and the oil expressed therefrom—croton oil—are highly poisonous. The oil is used in medicine as a purgative in doses of one-third of a minim to one minim. Applied to the skin, it vesicates. The Linimentum crotonis B.P., used as a counter-irritant external application, consists of one volume of croton oil to seven volumes of a mixture of equal parts of cajuput oil and rectified spirit. Three drops of the oil proved fatal to a child one year old, and half a drachm has caused death in an adult. In one case an adult died in four hours from a dose of 2½ drachms. One or two grains of the seeds, when swallowed, suffice to cause severe pain, with copious watery stools. A case also is reported in which severe symptoms (pain and collapse but no purging) appear to have been produced by inhaling the dust raised in emptying packages of the seeds.

The poisoned arrows of the Abor tribe of Assam were found to contain croton oil (Maj. Windsor, *I.M.G.* Jan. 1912), and derived from a paste of the pounded plant, and not the seeds.

[1] *Pharmacographia*, p. 504.
[2] *Mat. Med.*, p. 694.
[3] *Useful Plants*, p. 204.
[4] *Bo. Chem. Analyser's Rept.*, 1874–75.

Kobert, from recent researches, attributes the activity of croton oil to croton oleic acid (distinct from crotonic acid) present in the oil, both free and as a glyceride. Besides this, croton oil also contains the glyceride of a peculiar acid—tiglic or tiglinic acid—isomeric with angelic acid $C_5H_8O_2$.

IDENTIFICATION.—The seeds are oval, more arched on the dorsal than on the ventral surface, about half an inch long by nearly two-fifths of an inch broad, and weigh about four grains each. The testa is black, thin, and brittle, and more or less covered by a thin cinnamon-brown coat. The kernel is white, is enclosed in a delicate white membrane, and easily splits into two halves, between which lie two foliaceous cotyledons, and a short thick radicle. The oil may be extracted from the seeds or other matters by exhaustion with ether, and recognized by its vesicating action on the skin. The seeds of the following are stated to resemble those of croton tiglium in appearance and properties. *Baliospermum montanum*, vern. *Danti*. These, Dymock states, are often sold as *Jamálgota* by druggists; and *Croton oblongifolium*, *Baragach* (Beng.), *Ganasur* (Bo.), *Gonsurong* (Goa).

In croton poisoning pain is felt at the back of the throat, which comes on some time after the poison has been swallowed; and it is immediately relieved by a dose of bismuth.

Case.—**Croton-oil poisoning,** homicidal (attempt).—In a boarding-school at Patna in 1899 a boy servant was beaten by the cook and complained to his mother, who remonstrated with the cook; but obtaining no satisfaction she threatened to have her revenge. The cook, as usual, prepared the evening meal which was partaken of by four or five boys. A short time after they all exhibited symptoms of irritant poisoning, attended with frequent vomiting, looseness of bowels and pain in the abdomen. The medical man, who was called in, treated the cases as croton-oil poisoning. Some vomited matter and cooked food (rice and vegetable) were sent for examination, and croton-oil was detected in them. A quantity of curry powder was also forwarded, but it was found to contain no poison. The boys all recovered. It was suspected that the woman had mixed powdered croton-seeds with the cooked food in the kitchen during the cook's absence, croton-seeds being readily obtainable from any *baniya's* shop in the bazaar.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Castor-oil seeds and oil.—*Ricinus communis.*—*Arandi* (Hind.), *Erendi* (Bo.), *Bherenda* (Beng.), *Amanak-kani-chedi Sittamunak*, *Valluk* (Tam.), *Citavanakoo*, *Avanak*, *Pandiavanak* (Mal.), *Sittamindi*, *Amidum* (Tel.).—Castor-oil, if expressed from the peeled and winnowed seeds, without the aid of heat, is mildly purgative. The seeds, however, are highly poisonous. Three grains of the seeds have caused alarming symptoms, and a case is reported where three seeds proved fatal to an adult in

forty-six hours. Fatal cases of poisoning by castor-oil seeds administered in food have been reported. The poisonous principle of the seeds is an albumenoid body (*ricin*), a 'tox-albumen' resembling the active principle of *abrus* seeds (which see), which gives rise to violent inflammation of the alimentary canal, but not to catharsis, and ten seeds contain about one-tenth of a grain of ricin, or sufficient to cause death in an adult.[1] IDENTIFICATION.—Castor seeds resemble *croton tiglium* seeds in shape and internal structure, but are somewhat smaller. The testa also differs in colour, being grey marked with brown blotches. The oil is distinguished from other fixed oils by being soluble in glacial acetic acid and in alcohol. It is completely soluble in four volumes of spirits of wine at 15° C. There is

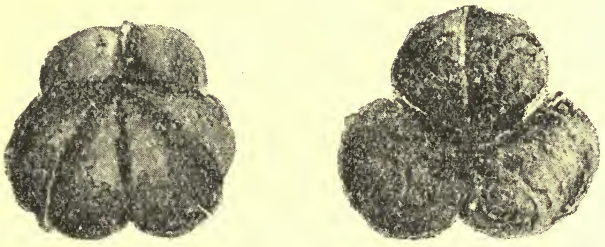


FIG. 42.—Physic nuts (*Jatropha multifida*).

also a large variety of castor seed, of a reddish colour with brown blotches, the oil obtained from which is much used for industrial purposes.

Physic Nuts.—*Jatropha curcas.*—*Jangli arendi* (Hind.), *Bágbheranda* (Beng.), *Moghli erendi* (Bo.), *Kattamanakku* (Tam.), *Galamark* (Goa).—The fruit of this and of the other jatrophas named below (physic nuts) contain oily poisonous seeds. The action of these seems to be similar to that of croton tiglium seeds, but somewhat milder in degree. The oil expressed from the seeds irritates the skin, and given internally, in doses of twelve to fifteen drops, is powerfully purgative. Severe vomiting and purging have been caused by swallowing a few grains of the cake left after expression of the oil from the seeds. Several cases of accidental poisoning by physic nuts are recorded, and Chevers mentions one where in addition to the usual irritant symptoms, muscular twitchings, deafness, impairment of sight, and loss of memory were present. The fruits of *J. multifida* and of *J. glandulifera*, *Undarbibi*, *Jangli erendi*

[1] Stillmark, *Drop. Arb.*, iii. 1889.

FIG. 43.—Jatropha Leaves (1, curcas; 2, glandulifera; 3, multifida).

FIG. 44.—Jatropha glandulifera.

(Bo.), *Lalbherenda* (Beng.), *Addaley* (Tam.), *Nela-amida* (Tel.), are quite as poisonous as those of *J. curcas*. IDENTIFICATION.—The fruits of all are three-celled and three-seeded. *J. multifida* has fruit as large as a walnut of the shape shown in Fig. 42. Those of *J. curcas* are of about the same size, but more uniformly oval in shape, and those of *J. glandulifera* are not bigger than a hazel-nut, oval, and marked externally with six deep longitudinal grooves. The three plants also may be distinguished by the shape of their leaves (see Fig. 43). The seeds of all three varieties in shape and internal structure closely resemble castor-oil seeds. *J. curcas* seeds are about three-quarters of an

FIG. 45.—Jatropha multifida.

inch long and rather less than half an inch broad. *J. multifida* seeds are somewhat broader, and *J. glandulifera* seeds are only three-tenths of an inch long and two-tenths of an inch broad. *J. curcas* and *J. multifida* seeds are black with a white scar at one end, while *J. glandulifera* seeds are grey with two brown stripes on the dorsum.

Other Euphorbiaceae.—The following other plants of this order are of medico-legal interest :—

Manihot utilissima (*Jatropha manihot*), the Cassava.—This plant is cultivated in Southern India for food, the boiled root being a staple of diet. It is a native of the West Indies, where its starchy root is used as an article of food under the name of *cassava*. From the root also is prepared the '*tapioca*' of commerce, after dissipating the poison by roasting. Two varieties of it exist—a sweet and a bitter variety. The latter abounds in a poisonous milky juice containing *hydrocyanic* acid, to which its toxic power is due. Owing to its volatility, however, this is entirely removed by heat, and hence bitter cassava root may be utilized as an article of food, after the juice has been squeezed out and the root has been cooked. Two fatal cases of poisoning by this root were reported from Madras in 1898; one a child, and another several families.[1]

Jatropha urens.—This also is a native of the West Indies, has leaves covered with stinging hairs, merely touching which has, it is said, in two instances caused serious symptoms. In one of the two reported cases extreme collapse came on in a few minutes. In the other "the pain and swelling in the part touched lasted for some days."[2] *Hippomane Mancinella, Manchineel.*—This tree, also a native of the West Indies, yields an acrid milky juice, which, applied to the skin, causes violent inflammation, and if administered internally acts as an irritant poison. Christison mentions that the *H. biglandulosa* and *H. spinosa* are equally poisonous.[3] *Hura crepitans*, the Sand-box tree.—Chevers, on the authority of Dr. H. Cleghorn, remarks that this, introduced from the West Indies, is not uncommon at the Presidency towns. The seeds are violently purgative.[4] *Lebidieropsis orbiculata, Wodisha* (Tel.), *Wodàgu marum* (Tam.) (Drury); *Odwan, Nachutu* (Tam.).—Drury, in regard to this shrub, states, "The bark or outer crust of the capsules is said to be very poisonous;" and Gribble[5] mentions that it has recently been identified as the probable poison, in some cases of irritant poisoning occurring in the Madras Presidency.

Karlajuri or Pasu.—*Cleisanthus collinus* (Benth.), *Cluytia collina* (Roxb.), *Lebide riopsis orbicularis*. Vern. '*New-larg.*' The bark of this tree, which grows in Chota Nagpur, is used by the Kols for poisoning fish, like *cocculus indicus*, and also occasionally as a human poison, and is said to cause vomiting and purging with cramps in the limbs and death in a day or two; see *Case* below. The rind of the capsule is said by Roxburgh to be poisonous.

Case.—**Poisoning by Karla-juri.**—Suicidal.—In 1897, some reddish-brown bark of a tree called '*Karla-juri*' was sent for examination from Singbhum, along with the viscera of a woman who was said to have died from its effects, having been eaten by her in order to commit suicide owing to a quarrel. She died two days after taking the poison. No poison was detected in the viscera of the deceased. But the alcoholic extract of the bark, which was administered to a full-grown cat, produced the following symptoms:—Vomiting, weakness in the extremities, tremor of the head,

[1] *Mad. Chem. Ex. Rept.*, 1898.
[2] Taylor, *Poisons*, p. 504.
[3] *Med. Jur.*, p. 275.
[4] *Poisons*, p. 592.
[5] *Med. Jur.*, p. 255.

widely dilated pupils, extreme prostration, and death in five hours. The ethereal extract of the bark was not poisonous. A portion of the plant was sent to the Botanic Gardens and identified as an *Euphorbiaceous species*, named *Cleisanthus collinus* (Benth. in *Flora of British India*).—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Liliaceæ.

Aloes.—*Elwa* (Hind. and Beng.), *Elia, Pivalabola, Kalabola* (Bo.), *Kariya-pólam* (Tam.).—This well-known medicinal substance is the inspissated juice of the leaves of the *Aloe vulgaris* and other species of aloe. It is a powerful drastic purgative, acting specially on the rectum. The usual medicinal dose is three to five grains. In large doses aloes is an irritant poison; two drachms has caused death; and a case was recently reported to the Bombay Chemical Analyser's Office in which a man appears to have died from the effects of swallowing, as a purgative, a decoction of wild aloe leaves. Aloes has a stimulant action on the uterus, and in Europe is frequently given or taken for the purpose of procuring abortion. A form in which it has often been used for this purpose is hiera picra or holy bitter, a mixture of four parts aloes to one of canella bark. Aloes also is an ingredient of Morrison's and most quack purgative pills. The active principle of Barbadoes aloes is barbaloin, a glucoside. Other varieties contain natalion and socalion, bodies probably members, with barboloin, of a homologous series.

Squill.—Officinal squill is the sliced and dried bulb of *Urginea Scilla* (syn. *Scilla maritima*). In doses of six to fifteen grains it acts as an emetic, and in larger doses as an irritant poison, causing vomiting, purging, griping pain, strangury, and bloody urine. In poisonous doses squill causes marked depression of the heart's action. Convulsions also have been observed in poisoning by this drug.[1] Twenty-four grains of the powder has caused death. The active principle is scillitin, apparently a glucoside.

Gloriosa superba.—*Lánguli, Karihári, Kulhári* (Hind.), *Bishailanguli* (Beng.), *Indai, Nagkaria* (Bo.), *Kalàippaikkizhaugu* (Tam.).—The tuberous root of this plant is popularly believed in India to be highly poisonous. Burmese girls are said to commit suicide by its roots when crossed in love.[2] According to Moidin Sheriff, however, it is not poisonous in twelve-grain doses, but acts as an alterative tonic and antiperiodic.[3] In large doses it appears to be poisonous, acting in the same manner as squill (see *Case* below), and Warden isolated a bitter principle from the root, which he has named *superbine*, and considers to be closely allied to, if not identical with, scillitin. Identification.—Dymock describes the

[1] Christison, *Poisons*, p. 214.

[2] But Mr. Hunter, Chem. Exmr., Rangoon, has only had about six such cases referred in eleven years.

[3] Dymock's *Mat. Med.*, p. 833.

FIG. 46.—Gloriosa superba. Root. (Natural size.)

root (see Fig. 46) as "tuberous, cylindrical, and flattened, often seven to eight inches long and about one inch in diameter; it consists of two tubers which unite at a right angle, one being much smaller than the other; at the point of union may be seen on the upper surface a circular scar marking the attachment of the stem, and on the under surface, immediately beneath it, another, to which a tuft of thin rootlets is often attached. The tubers are covered with a brown epidermis, except at the point, which is tapering and nearly white, like the growing part of a young kidney potato. Internally they are juicy, white, and farinaceous, and have a faint acrid odour; the taste is mucilaginous, feebly bitter, and a little acrid." Gloriosa superba root is said to be used in India as an adulterant of aconite root.

Case.—**Poisoning by gloriosa superba.**—Dr. Battacharjee, *Ind. Med. Gaz.*, 1872, p. 153, reports the following case:—A female, *æt.* 18, swallowed a quantity of the powdered root. Symptoms of poisoning appeared in half an hour, and were: retching, violent vomiting, spasms, and contortions of the body, with fearful racking pain; from time to time there were short intervals of relief, followed by recurrence of the same symptoms. Death took place in four hours. The *post mortem* appearances were congestion of the brain, and its membranes, with extravasations of blood. The lungs, liver, and kidneys were all deeply congested. The gastric mucous membrane showed signs of inflammation. The peritoneal covering of the fundus of the uterus (unimpregnated) was also found inflamed.

Ranunculaceæ.

The Hellebores.[1]—These, natives of Europe, are all highly poisonous. The principal species are *H. niger*, or Christmas rose, the *melampodium* of the old Pharmacopœias; *H. fœtidus*, bears'-foot, fetter-wort, or felon-grass, and *H. viride*.[2] They are compound irritants, causing violent vomiting and purging (the latter, however, has in some cases been absent), and great collapse. Convulsions and insensibility have also been observed. Two poisonous glucosides have been obtained from the hellebores, namely, helleborin and helleborein. These, especially the latter, are powerful heart poisons. Black hellebore root, in doses of a few grains, acts as a drastic purgative, and thirty grains of an aqueous extract of the root has proved fatal to an adult. The leaves of the hellebores are also poisonous, and a case is reported where a child, *æt.* 2, was killed by two dessertspoonfuls of an aqueous infusion of the leaves of *H. viride*, given as a vermifuge.

Anemone pulsatilla and other species of anemone, and *Ranunculus acris* or 'buttercup,' *R. sceleratus*, and other species of ranunculus, contain an acrid oily matter, acting as a vesicant when applied to the skin, and when swallowed as a compound irritant poison, causing, in addition to

[1] The name "hellebore" is also applied to certain species of veratrum plants belonging to the N.O. *Melanthaceæ*.

[2] Murray's *Plants of Sind*, p. 73.

the usual symptoms of irritant poisoning, depression of the heart's action, slow respiration, paralysis, and convulsions. The acrid oily matter may be separated from the plants by distillation with water; and the plants, on drying and exposure, after a time lose their activity. The acrid oily matter on keeping decomposes into anemonic acid, apparently inert, and anemonin, which is actively poisonous. Murray notices that *R. sceleratus* grows in Sind and the Panjab, and is virulently poisonous.

Actaea racemosa (syn. *Cimicifuga racemosa*), Black snakeroot or black Cohosh.—The rhizome and rootlets of this plant are officinal in the United States Pharmacopœia. In large doses it causes nausea and vomiting, and depresses the action of the heart. In one case abortion is reported to have followed its administration. *Adonis vernalis*, regarded by some as species of anemone, must also be mentioned as a poisonous plant belonging to this order. It contains a glucoside (adonidin) acting as a cardiac depressant like digitalis. Vomiting and diarrhœa are more readily produced by *Adonis vernalis* than by digitalis.

To this order also belong the alkaloidal *Delphinium staphysagria* and *Aconitum napellus* and *A. ferox*, which are cerebro-spinal and cardiac poisons.

Thymelaceæ.

Mezereon.—*Daphne mezereon*, and *D. laureola* [or Spurge-Laurel] and other species of the same genus, are compound irritant poisons. A few accidental fatal cases of poisoning by the bright red berries of *D. mezereon* are recorded, the symptoms being vomiting and purging, followed by narcotism with dilated pupils. The bark also is poisonous, and appears to contain a fatty vesicating oil. Several members of this genus are found in India, and Burton Brown[1] mentions that the root and stem of one species (apparently *D. papyracea*), growing on the hills, is a powerful irritant, known under the vernacular name of '*Gundhera*,' and that it can be recognized by the peculiar woody tissue which forms the inner bark, and which is composed of long white fibres, easily separable from the wood. *Lasiopsiphon speciosus*, vern. *Rametha*.—The bark of this shrub, common on the Ghauts, is a powerful vesicant, and is used for poisoning fish. Dr. W. Gray mentions a case in which administration of the leaves of the plant caused irritant symptoms, followed by abortion and death.[2] Dymock describes the bark as acrid in taste and consisting "of an outer tuberous portion, which is of a light brown colour, and divided by numerous transverse and longitudinal fissures, so that it can be easily separated, and of an inner layer, which is white, tough, and silky like mezereon."

Aroideæ.

The tuberous roots of many of the *arums*, a genus of this order, when taken into the mouth, cause immediate burning pain, great swelling of the tongue, and salivation, and when swallowed give rise to symptoms of irritant poisoning. The roots of many contain much starch, and are used, after washing and baking, as articles of food. The following may be specially mentioned:—

Arum maculatum, 'lords and ladies,' cuckoo-pint.—This, common in England, has given rise to several cases of accidental poisoning, chiefly

[1] On 'Poisons used in the Panjab,' quoted by Chevers, p. 285.
[2] *Bo. Analyser's Rept.*, 1874–75, p. 10.

among children, from eating the leaves. In some of the cases convulsions and dilated pupils are reported to have been present. The tuberous root—poisonous when fresh—after steeping in water and baking, is used as an article of food under the name of Portland Sago—*Arum seguinum—dumb cane.*—A native of the West Indies. Two drachms of the juice of this plant has been known to prove fatal in a few hours. *Arum montanum, Konda-rakis* (Tel.), and *Arum lyratum, Adavi.*—These are both, Drury states, natives of the mountainous parts of the Northern Circars. The root of the first is so poisonous that it is used to poison tigers; the root of the second is used as an article of food, but requires careful cooking. *Synanthérias sylvatica* (syn. *Arum sylvaticum*), *Uzomut* (Goa), *Wajrmut* (Mar.).—Dymock notices that the seeds of this produce the local effects noted above, followed by numbness, and states that the crushed seeds are used in the S. Concan, on account of their benumbing effect, as a remedy in toothache. *Arum colocasia* (syn. *Colocasia antiquorum*), vern. *Kachu* or *Bish Kachu.*—It is used as an article of diet in India when roasted or boiled. Two cases of poisoning by the tubers of this plant, both non-fatal, were reported in Bengal, in 1886 (see below).

Case.—**Arum—Kachu poisoning.**—In a case from Dibrugarh in Assam, a sick coolie had some fried *Kachu* administered to him and experiencing a burning sensation spat it out, whereon a pig ate what had been ejected and died in an hour, and a second pig was given some and also died. Dr. Warden failed to extract from the tubers any active principle, but found them to contain bundles of needle-shaped crystals of oxalate of lime, which would, he thought, mechanically account for the irritant symptoms; but boiling destroys the poison of most Arums and has no effect on the oxalate of lime.

Amaryllideæ.

Daffodil.—*Narcissus pseudo-narcissus.*—This, common in England, is mentioned by Guy and others as an irritant poison. Other species of narcissus also have a similar action. The root of an Indian plant of this order, namely, *Crinum asiaticum*, vern. *toxicarium*, is officinal in the Pharmacopœia of India as an emetic, and Dymock mentions that the bulb of *Crinum ornatum, Gadambikanda* (Bo.), is extremely acrid, and it is used for blistering cattle, a slice being bound on the skin.

Other Orders.

Argemone mexicana, N. O. *Papaveraceæ; Bharbhand* (Hind.), *Brahma-dandi* (Sans.) *Shiál kánta* (Beng.), *Dáruri* (Bo.), *Feringi datura* or *Pila datura* (Duk.).—The seeds of this plant yield an oil which, when swallowed, causes vomiting and purging. In 1878 four cases of accidental poisoning in Bombay from the use of this oil in food, in each of which several persons were affected, were reported. IDENTIFICATION.—The seeds are contained in prickly capsules, three-quarters to one and a half inches long. They are dark brown in colour, nearly globular, about one-fifth of an inch in diameter, and covered with minute, regularly arranged projections and depressions. One hundred of them weigh about three grains. The oil, shaken with an equal volume of strong nitric acid, acquires a deep crimson colour, the acid at the same time becoming similarly coloured. The crushed seeds, warmed with strong nitric acid, give a

similar reaction. Dragendorff has found the seeds to contain an alkaloid possessing reactions similar to those of morphia.

Capsicum annuum or 'Chillies,' N.O. *Solanaceæ; Lalmirch* (Hind., Bo., and Beng.), *Milagày* (Tam.).—The fruits of this and of other species of capsicum contain an exceedingly acrid, volatile, non-alkaloidal substance, capsicin, apparently the active principle; and also a volatile alkaloid, with an odour like conia. Applied to the skin, capsicum causes irritation and vesication, and, taken internally in sufficient quantity, acts as an irritant poison. Owing to the volatility of the active principle, the fumes arising from burning capsicum are highly irritant. The medicinal dose is half a grain to one grain.[1] Woodman and Tidy mentioned a case where quack pills containing capsicum proved poisonous to a woman, aged seventy-four; and Taylor[2] mentions a case where a quack was tried for causing the death of a boy, aged fifteen, who was suffering from hip-joint disease, by giving him a mixture containing Cayenne pepper; the prisoner, however, was acquitted.. Capsicum is frequently used in India for purposes of torture. Chevers mentions its use for this purpose in the following ways:—Introduction into the nostrils, eyes, vagina, or urethra; burning it under the nose, rubbing it on the breasts of females, and covering the head with a bag which has contained it. IDENTIFICATION.—The appearance of the fruit is well known. The seeds are of a flattened kidney shape, about a quarter of an inch long and wide, and closely resemble datura seeds. Like datura seeds, the testa under the microscope is seen to be covered with convoluted ridges. They differ from datura seeds (1) in having a pungent taste; (2) the convex border is single, not double, as in the datura seed; and (3) on section the embryo is seen to differ in shape from that of the datura seed (Figs. 47 and 58).

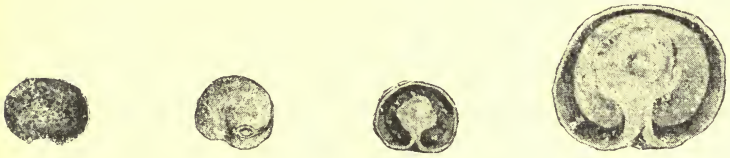
Cocculus indicus, or Levant nut.—The fruits or berries of the *Anamirta cocculus*, N.O. *Menispermaceæ;* vern. *Kakmiri* (Hind.), *Kakphul, Karwi* (Bo.), *Kakkay-kolli-virai* (Tam.)—These are highly poisonous, owing their activity to the presence of *picrotoxin*, a crystallizable non-alkaloidal principle, contained in the seeds, but not in the pericarp of the fruit. The pericarp, in fact, is non-poisonous, and an entire berry might therefore possibly pass through the body without causing bad symptoms. *Symptoms:*—Picrotoxin is an irritant poison, causing vomiting,

[1] Bentley and Redwood, *Mat. Medica*, p. 625. Taylor, *Poisons*, p. 505, gives the medicinal dose as five to ten grains.

[2] *Poisons*, p. 505 (*R.* v. *Stevens*, C. C. C., May, 1864).

purging, etc., with extreme giddiness, faintness, dimness of vision, followed by delirium and epileptiform convulsions, stupor, and loss of voluntary power.

A few cases of poisoning by cocculus indicus berries have occurred in Europe and America. In one case a child died from the application of an alcoholic tincture of the berries to the head. A decoction or extract of *cocculus indicus* has been used in England as an adulterant of beer, porter, etc., in order to increase its intoxicating power; and it is said to be largely used for the same purpose by the liquor retailers of Bombay. In England *cocculus indicus* has been used by thieves to stupefy their victims in order to facilitate the commission of theft; and in 1881 a case was referred to the Bombay Analyser, in which it was alleged that it had been used for a similar purpose. The Bombay records also show that during the last ten years cocculus indicus was detected in three cases of alleged cattle poisoning. In India cocculus indicus berries



Exterior. Natural size. Section (natural size). Enlarged section.

Fig. 47.—Cocculus indicus.

are used as in England as a fish poison. In medicine cocculus indicus is only used as an external application as a parasiticide (see also 'Spinal poisons'). Fatal period.—Of six persons accidentally poisoned by decoction of the berries, two died within half an hour, the remaining four recovering after several hours.[1] Identification.—The dry berries are nearly globular, about half an inch or rather less in diameter, and have a blackish wrinkled surface. On section they are seen to contain a peculiar mushroom-shaped body, consisting of a cup-shaped seed, supported on a stalk formed by a projection inwards of the endocarp (see Fig. 47). The pericarp is tasteless, the seed is bitter. From organic mixtures picrotoxin may be separated by digesting the matter under examination with alcohol, evaporating the alcoholic tincture nearly to dryness, and treating the extract so obtained with acidulated water. The acid watery solution is then to be filtered, shaken with ether, and the latter separated

[1] Wharton and Stille, *Med. Jur.*, 499.

and evaporated to dryness, when picrotoxin, if present, will be found in the residue. Picrotoxin is not precipitated from solution by the group tests for the alkaloids. It has a bitter taste, reduces alkaline copper solutions like grape sugar, and dissolves in strong sulphuric acid, forming a yellow solution, which on addition of a trace of potassium dichromate becomes violet, changing into brown.

Ergot.—This is the sclerotium (compact mycelium) of *Claviceps purpurea*, a fungus parasitia within the paleæ of numerous plants of the order Graminaceæ. Rye so affected constitutes the ergot of rye used in medicine. Other cereals, *e.g.* wheat and oats, are liable to the affection.[1] In large single doses ergot causes the usual symptoms of irritant poisoning, accompanied by headache, giddiness and stupor, depressed action of the heart, and dilated pupils. Acute poisoning by ergot is very rarely met with. Outbreaks of ergotism, or chronic poisoning by ergot, arising from the use of affected grain as food, have occurred in France and Germany. Ergotism shows itself in two forms—a convulsive and gangrenous form. Both commence with gastrointestinal disturbance. In the first, giddiness, aberrations of vision, loss of sensation in the hands and feet, spasms and convulsions, are the prominent symptoms. In the second, dry gangrene of the extremities is the principal effect.

Ergot causes contractions of the uterus, especially of the pregnant uterus, and hence is used sometimes criminally as an abortifacient. In the early stages of pregnancy, however, it sometimes fails to excite contractions of the uterus. Thus Taylor mentions a case where a woman took about a teaspoonful of tincture of ergot three times a day for eleven weeks, and died at about the third month of pregnancy without having aborted.[2] The medicinal dose of powdered ergot in uterine diseases is 5 to 15 grains three times a day, but its administration should not be continued for any length of time. The dose for a woman in labour is 20 to 60 grains. Doses of 30 to 120 grains have caused symptoms of poisoning. IDENTIFICATION.—Ergot appears to contain more than one active principle,[3] none of which, however, possess chemical characters sufficiently distinct to enable them to be recognized with certainty. Ergot of rye consists of fusiform grains one-quarter of an inch to one and a half inch

[1] Chevers mentions that in India a disease called '*leera*' appears in barley and oats, and a similar disease called '*kindol*' appears in *Bajri*, and points out that grain thus affected resembles ergot of rye.

[2] Taylor's *Manual*, p. 513.

[3] The latest researches are those of Kobert; according to this authority ergot contains three active principles, viz. (1) ergotinic acid, this paralyses the spinal cord, but does not appear to act on the uterus; (2) sphacelinic acid, this causes spasmodic contraction of the arterioles, resulting in gangrene or extravasations of blood; and (3) cornutin, a convulsant causing clonic and tonic spasms.

in length, and about one-sixth to one-third of an inch thick. Externally the grains are deep purple, internally they are white or pink. They have a peculiar fishy odour, which becomes more developed on the addition of potash. Ergots of other grains chiefly differ from ergot of rye in length and thickness.

Gamboge, *Ussaráh-i-Rewand, Gotaganba* (Pers., Hind., and Bo.), *Mukki* (Tam.).—This is a gum resin from *Garcinia morella*, N.O. *Guttiferæ*, and is used in medicine in doses of one to five grains as a drastic purgative. One drachm has caused death. A case, however, occurred in Bombay in which a girl, *æt.* 19, intending to commit suicide, swallowed three drachms, but recovered under treatment. IDENTIFICATION.—A tawny or brownish orange substance, generally met with in cylinders one to two and a half inches in diameter, with an acrid taste, forming a yellow emulsion with water, and violently purgative.

Moringa pterygosperma, the Horse-radish tree, N. O. *Moringeæ*, *Sahjna* (Hind.), *Shegra*, *Shegat* (Bo.), *Murungai* (Tam.).—The fruit of this tree is eaten as a vegetable, and the root is used as a substitute for horse-radish, which it exactly resembles in taste. K. Lall Dey[1] states that one of the methods of procuring abortion in use near Calcutta, is the administration of a dose consisting of about half an ounce of pounded sahjna bark mixed with twenty-one black pepper-corns, and that this is a very dangerous means, the mother as a rule dying when it is resorted to.

Lal-Chitra.—*Plumbago zeylanica.*—*Chitrak* (Hind.), *Chitta* (Beng.), *Chitra* (Bo.), *Chittira* or *Chittira Mulam* (Tam.); and *Plumbago rosea* (syn. *P. coccinea*), *Lal-chitra, chita*, or *chitra* (Hind., etc.), *Shivappu chittira* (Tam.), N. O. *Plumbagineæ* (see Fig. 48).—The roots, and probably other portions of these plants, contain a highly acrid crystallizable non-alkaloidal principle called *plumbagin*. The bruised roots applied to the skin cause vesication. Taken internally, in large doses, plumbago root acts as an irritant or narcotico-irritant poison.

Plumbago root in India is sometimes administered internally as a poison, and Chevers[2] refers to two fatal cases, one of them a case of homicide, in which it was so employed. More commonly in India plumbago root is used for the purpose of causing abortion. With this object it is sometimes given internally, and has been more than once detected as plumbagin in pills stated to have been administered for this purpose. Usually, however, it is employed as a local irritant application to the *os uteri*, a portion of the root or a twig of the plant being pushed into the vagina, and sometimes even into the uterus. In other cases the cotton-covered end of an abortion-stick (p. 321) is smeared

[1] Chevers, *Med. Jur.*, p. 716. [2] *Med. Jur.*, p. 252.

with a paste made from the powdered roots; and I once met with a case in which a lump of such paste was simply thrust into the upper part of the vagina, and was found there after death. It is also used as an irritant to skin by malingerers or to support false charges, see *Case* below.

Detection.—The roots are $\frac{1}{4}$ to $\frac{1}{2}$ an inch in diameter, dark brown externally, and reddish within; from them and matters

Fig. 48.—Plumbago zeylanica.

containing it, plumbagin may be extracted by digesting the substance under examination with alcohol, straining this off, and evaporating the tincture to dryness. The dry residue from the tincture should then be digested with a small quantity of water rendered slightly alkaline with caustic potash, the solution obtained filtered, acidulated with hydrochloric acid, and shaken

with ether. The ether is then separated, evaporated to dryness, and the residue tested for plumbagin. Plumbagin treated with caustic potash solution dissolves, forming a bright crimson liquid. Hydrochloric acid added to this changes the colour to yellow, and on standing the liquid deposits yellow flocculi of plumbagin, which may be separated by shaking the acidified fluid with ether. An alcoholic solution of plumbagin gives a crimson precipitate with solution of basic acetate of lead.[1]

Case.—**Lal-Chitra applied to skin to fabricate a 'bruise.'**—In 1898 a case was reported of a false charge of dacoity having been made at Murshedabad, Bengal, in which the alleged injuries of the complainant were shown by the civil surgeon to have been artificially produced by the application of this irritant. The man, Jitan Ali Mir, was found guilty of bringing a false charge, and sentenced to four years' imprisonment.—*Ind. Med. Gaz.*, 1900, p. 8.

Plumieria acutifolia (syn. *P. acuminata*), N. O. *Apocynaceæ; Khairchampa* (Bo.), *Gobur champa* (Beng.), *Dolochápo* (Guz.) (see Fig. 49).—This small tree, common in India, has blunt truncate branches and white and yellow flowers. It abounds in viscid juice, which dries into a substance resembling india-rubber. "The root is a violent cathartic, and the blunt-ended branches are used to procure abortion."[2] The plant does not give any blue or green reaction with hydrochloric acid, like *Cervera thevetia* and *C. odallum*. It contains plumieric acid in combination with calcium.[3]

Eve's Apple-Tree or **Kaduru,** or *Tabernæ-montana dichotoma R.*, N. O. *Apocynaceæ*. This is a native of Ceylon and South India. Its Ceylonese vernacular name is *Diar Kaduru* (*Kadura* = "tiger"). Flower emits a fine scent. Fruit attractively coloured and of tempting appearance, orange externally and deep crimson within. Shape globular with appearance of a piece bitten out. Is deadly poisonous, but its symptoms have not been described. It is called by Mohammedans "the Forbidden Fruit of Eden," and by South Europeans "Eve's Apple."

Randia dumetorum, N. O. *Rubiaceæ; Mainphal* (Hind.), *Gelaphal* (Bo.), *Maruk-kailàn-kay* (Tam.), *Menphal* (Beng.), *Mindhal* (Guz.) (see Fig. 50).—Dr. George Bidie[4] states that the fruit of this is apparently an irritant emetic, and is used to

[1] A colouring matter obtained from rhubarb root gives, with caustic potash solution, a crimson colour similar to that given by plumbagin. An alcoholic solution of it, however, gives, with acetate of lead solution, an orange precipitate, not a crimson precipitate like plumbagin.

[2] S. Arjun, *Bom. Drugs*, p. 210.

[3] Watts, *Dict.*, VIII., p. 1656.

[4] *Pharm. of India*, p. 118.

produce emesis by the poorer classes in Mysore, the dose being one ripe fruit well bruised. According to Ainslie, an infusion of the root bark also acts as an emetic; and Dymock mentions that the bruised nut is used in the Concan to preserve grain from the attacks of insects, and as a fish poison; Chevers,[1] on the authority of Edgeworth, states that the fruit is used in the

FIG. 49.—Plumieria acutifolia.

FIG. 50.—Randia dumetorum.

neighbourhood of Jalandhar, as an ingredient in medicines given by the mouth for the purpose of procuring abortion. IDENTIFICATION.—Dymock [2] gives the following description of the dried fruit:—"About the size of a crab apple, globular or oval, reddish brown, crowned with the rim of the calyx. It consists of a pericarp and shell, which contains the seeds

[1] *Med. Jur.*, p. 720.

[2] *Mat. Medica*, p. 408.

embedded in pulp. The shell is hard and thick, two-celled, the dividing septum being thin and membranous. The pulp is grey, and has a nauseous taste and smell. The seeds are small and oblong, about $\frac{1}{8}$th of an inch in length, slightly flattened, very hard, and of a brown colour. The average weight of the fruit is about sixty grains." In the dried fruit the seeds are found agglutinated together into two rough masses, each something of the shape of a coffee bean, but larger, one mass in each cell of the fruit.

Rue, *Ruta graveolens*, N. O. *Rutaceæ*, yields by distillation a pale yellow volatile oil of a strong disagreeable odour and acrid bitter taste. The oil—officinal B.P. and I.P.—appears to be the active principle of the plant, and is used in medicine, internally as an emmenagogue in doses of from two to five drops, and externally as a rubefacient. Garrod gives the medicinal dose of the powdered leaves as twenty to forty grains. In large doses, rue acts as an irritant poison, causing vomiting and prostration, with a feeble slow pulse and coldness of the extremities. Swelling of the tongue and salivation have also been observed. In Europe, rue has been frequently given or taken, it is said with success, as an abortifacient. *Ruta angustifolia*, *Sudab* (Hind.), *Sutap* (Bo.), *Arvada* (Tam.), is cultivated in most parts of India, and is used in native medicine in the same way that *R. graveolens*—for which it appears to be a perfect substitute—is used in Europe.

Savin.—The leaves and tops, and the berries of *Juniperus sabina*, N. O. *Coniferæ*, contain an acrid volatile oil—oil of Savin—which, when applied to the skin, acts as a vesicant, and when swallowed, as an irritant poison. In addition to its irritant action on the alimentary canal, savin causes congestion of the kidneys and uterus. Owing to its action on the kidneys, strangury, hæmaturia, and even suppression of urine, may be present in cases of poisoning by it. Savin is used in medicine as an emmenagogue in doses of five to fifteen grains of the powdered tops, or one to fifteen minims of the oil. In England, savin is popularly believed to be an effectual abortifacient, and cases of poisoning by it are generally due to its having been given with this object. Savin often fails to cause abortion; sometimes it succeeds, generally, however, at great risk to life. Several cases are recorded where its administration caused abortion, followed by the death of the woman. Identification.—There is no reliable chemical test for the oil. If the leaves or tops have been given, fragments of these may be found and identified by comparison with a known specimen. The woody fibres, like those of other coniferæ, exhibit circular discs. The leaves are minute and have a sharply accuminated point, while those of yew, another poisonous plant of the same order, have a lancet-shaped apex. Savin leaves differ also from yew leaves in giving off when rubbed a strong peculiar odour.

Soap-nuts, *Ritha* (Hind. and Bo.), *Ponnau-kottai* (Tam.), *Ringin* (Mar.), the fruit of *Sapindus trifoliatus* (syn. *S. emarginatus*), N. O. *Sapindaceæ*.—These are scarcely to be considered 'poison.' According to Dymock, the pulp, in four-grain doses, is given internally as an anthelmintic and tonic, and a native authority recommends its administration in seventy-grain doses, with about eight grains of scammony, as a purgative. Soap-nuts contain the glucoside saponin,

a white amorphous powder, soluble in water, and forming a solution which froths like a solution of soap. Saponin is an undoubted poison. Blyth states that one and a half to three grains of saponin administered by the mouth produces slight symptoms in the human subject, and estimates that forty grains administered subcutaneously to an adult would endanger life. Saponin locally applied acts as an irritant, subsequently producing paralysis and anæsthesia; absorbed into the system, it paralyses the nerve-centres and the heart. Hence, as stated by Blyth, in poisoning by saponin the symptoms would probably be great muscular prostration, weakness of the heart's action, and diarrhœa, and after death *post mortem* appearances of irritant poisoning would probably be found. Saponin is present in many other plants, *e.g.* in senega; in sarsaparilla; in the bark of *Quillaia saponaria* (soap bark), and in *Agrostemma githago* or 'common *corn-cockle*.' Blyth suggests that accidental mixture of corn-cockle seeds with wheat may possibly account for some of the mysterious cases of poisoning which have occurred from time to time after eating cakes, bread, etc. IDENTIFICATION.—The dry berries of *S. trifoliatus* have a shrivelled brown translucent skin, and are met with either in threes united together or separate, and showing a heart-shaped scar on one side; each berry contains a single dark red-brown seed of similar shape to the fruit. The fruit-pulp has a fruity smell; its taste is sweet at first, afterwards very bitter. Saponin may be obtained from matters containing it by digesting them with hot spirit, from which the saponin deposits as the liquid cools. The deposited saponin may then be purified by dissolving it in the least possible quantity of boiling water. On the addition of absolute alcohol to this, the saponin precipitates. Saponin is insoluble in cold alcohol and in ether, strikes a red colour with sulphuric acid, and dissolves in water, forming a soap-like solution.[1]

Paka or **Kusum**, the seeds of *Schleichera trijuga*, N. O. *Sapindaceæ*. The seeds of this plant, the *Kusum* of Bengal and the *Kosumba* of Ceylon and the Straits, which is the so-called "*Lac*-tree" of India, yield an oil which has been found by Dr. Chuni L. Bose[2] to be occasionally mixed as an adulterant with Mustard oil or Macassar oil and thus cause irritant poisoning symptoms. This oil is a yellowish-white clear liquid consisting, according to Lavkoivitoch, of glycerides of lauric palmitic, arachidic, oleic and other fatty acids, and *hydrocyanic acid* in small proportions is always present, about 0·3 per cent. (Bose). The *symptoms* induced by these seeds or their oil are those of irritant poisoning, with giddiness, dilation of pupils, and in fatal cases death by syncope presumably due to the hydrocyanic acid. *Post mortem* shows congestion of stomach and internal organs, and the blood has a bright red colour as in hydrocyanic acid poisoning. IDENTIFICATION.—Fruit is a grape of the size of a nutmeg and coated by soft blunt prickles. The seeds are brown, oval and smooth, about ½ an inch in length; the kernel has a deep groove along its middle and yields the oil called "*Paka* oil" of the composition above noted.

Myrabalans, . *Terminalia bellerica*, N. O. *Combretaceæ; Bhairah*, *Bahera* (Hind. and Beng.), *Behada*, *Hela* (Bo.), *Taurik-kay* (Tam.).—Two cases of accidental poisoning by the fruit of this tree have been reported. In one,[3] three boys were poisoned; all, however, recovered. In the other,[4] a woman and two children, one of whom was a weakly girl

[1] Blyth, *Poisons*, p. 439.
[2] *Ind. Med. Gaz.*, 1919, Nov.
[3] Chevers, *Med. Jur.*, p. 273.
[4] *Bo. Chem. Analyser's Rept.*, 1878–79, p. 14.

of eight or nine, were poisoned, and of these the girl died, the two others recovering. The symptoms present were nausea and vomiting, followed by narcotism. The narcotic properties of the fruit reside in the kernel, but it is not known to what they are due. IDENTIFICATION.—The fresh drupe is obovate, somewhat five angled, about the size of a nutmeg, fleshy, and covered with a grey silky down. When dry it is of the size of a gall-nut, and of a dirty brown colour and astringent taste. It contains abundance of tannin. The stone is hard, and encloses a sweet oily kernel.

Jequirity or Indian Liquorice.

Abrus precatorius, N. O. *Leguminosæ;* vernacular, *Rati, Gunj, Gungchi* (Hind.), *Gunza* (Bo.), *Gudumani* (Tam.), *Charroti* (Guz.).—The seeds, roots, leaves, and other parts of this plant are irritant when applied to mucous membranes, and may be swallowed in considerable quantity without producing any ill effect, but if a small quantity of the seeds or of other portions of the plants be bruised and their juice injected under the skin of an animal, it rapidly proves fatal, producing general depression, drowsiness, fall of temperature, and hæmorrhagic lesions somewhat as in poisoning by snake venom. It is largely used in India for the criminal poisoning of cattle and occasionally for homicidal purposes (see *Case*, p. 589). For poisoning cattle it is used by the low caste leather-workers (*chamars*) in order to procure hides cheap. They pound the decorticated seeds into a paste with water and make the mass into small sharp-pointed spikes or 'needles' (*sui* or *sutāri*), which they harden in the sun. When used, two of the *suis*, which are about three-quarters of an inch in length, are inserted into holes in a wooden handle by their base. A blow is then struck with great force, driving the *sui* protruding from the handle into the animal's flesh, where it is left, and causes death within 18 to 24 hours.

Action.—The irritant and poisonous action of Jequirity seeds was ascribed by Cornil and other continental pathologists to a bacillus. Dr. L. A. Waddell disproved this theory, by an elaborate research[1] supervised by Professor Robert Koch, and in conjunction with Dr. Warden showed that the active principle was a chemical substance of a proteid nature which they isolated and called *abrin*. Abrin is a tox-albumen bearing much resemblance to snake-venom; and animals may become immune against it by repeated doses, and, like snake-venom, it has been resolved into globulin and other forms of albumin.[2] It acts as

[1] *The Non-bacillar Nature of Abrus-Poison*, Beng. Secretariat Press Calcutta, 1884. [2] *Ibid.*

a blood-poison, imparting to the red blood corpuscles a tendency to coagulate and form thrombi. Of the seed, half a grain subcutaneously injected is sufficient to kill cats in twenty to forty hours, and one and a half to two grains is sufficient to kill cattle within forty-eight hours. In animals killed by abrus poisoning, œdema of the subcutaneous tissue is found at the seat of the injury if the animal has lived over twenty-four to thirty hours. The mucous membrane of the stomach and intestine is found highly injected, and numerous hæmorrhagic points are seen on the surface of the mucous membrane of the intestine, and also in the interior of vascular organs, *e.g.* the lungs, liver and spleen.[1]

Identification.—The seeds are spherical, about the size of a pea, polished, and of a bright scarlet colour, with a large black spot at one end, other varieties are white or blackish; their microscopical structure is peculiar.[2] Their average weight is about one and three-quarters to a little over two grains. The root of this plant is officinal in the Pharmacopœia of India as a substitute for liquorice, and the seeds are used as small weights by jewellers, a '*rati*' being the weight of one seed. For identification of the suis small slices or scrapings are made with a sharp knife, placed with a drop of water on a slide, and examined with a microscope. The characteristic thick walled cells from the Abrus seeds are readily recognized.[3] A drop of a dilute extract of a sui if placed in the eye of a frog causes, within 24 hours, an intense inflammation.

Case.—**Hypodermic poisoning by Jequirity** (*abrus*) *seeds—Homicidal.*—At Bankipur, Bengal, in 1880, a man was killed by a *sutāri* driven into his neck by a *chamār* at the instance of a woman. The latter deposed as follows:—"I used to earn my living at Sunt Aman Khan's. His *chela* turned me out and would not give me sufficient food. I stole a seer of rice, and he abused and beat me. I was crying over my ill-fate. Mugyra said, 'Why are you crying?' I said, 'If some one killed him it would be well.' She said, 'Call Suntokhi, and he will put you up to something.' I then went to Suntokhi Chamār, and told him to get some medicine that would kill Aman Khan. He said he would go to Magha and bring some. After ten days he told me he had not been to Magha. Mugyra then told me to go to Dooly Chamār, who was a great poisoner, and had killed several persons. Dooly on being spoken to asked for 50 or 100 rupees. I therefore remained quiet. After ten days Dooly came to my house and wanted five rupees and seven pieces of cloth of seven colours, and black pigeons and a black kid. I gave him one rupee and a half, the price of the things. The next morning he came to me for five rupees advance, saying he would destroy my children, if I did not pay it, by

[1] L. A. Waddell, *op. cit.*

[2] By Dr. Norris Wolfenden and others, *Proc. Roy. Soc.*, 1889.

[3] Described by Dr. D. Cunningham, *Ind. Med. Gaz.*, 1882, and reproduced in *Pharmacograph. Indica*, I., 432.

means of witchcraft. I paid him five rupees; after this he again threatened me, and I gave him ten rupees. When eight or ten days had passed he said he would do what I wanted, and on the night fixed, he smoked in my house, and then at midnight *stabbed the wrong man.*" Both prisoners were sentenced to transportation for life under ss. 304 and $\frac{304}{109}$ of the *Penal Code.* The wound was penetrating about $\frac{3}{4}$ inch deep on the right cheek, it was incised, and "2 small, black, hard substances" extracted. The patient died on the third day—"The brain and its membranes and the lungs, liver, spleen, and kidneys were congested. The coats of the stomach were congested, and some ecchymosed spots were visible on its internal surface."—Dr. Warden in *Pharmacograph. Indica*, I., 446.

Case.—In 1873 a man near Rawalpindi when sleeping was awakened in the morning by two blows on the neck, and appears to have seen his assailant retreating. After he went to work, his mother found two substances, each a little larger than a barley-corn, on his bed. At midday he complained of pain in the neck, and his mother found two punctures, and out of one of these she picked a small black substance similar to those found on the bed. He was taken to Rawalpindi on a *charpoy*, arriving the following morning, and immediately examined by Dr. Ince, who reported: "I found a swelling on the right side of the neck in which were two small punctures about 2 inches apart. He was then sensible, but suffering from severe pain in the neck, difficulty of swallowing, and much fever. The swelling and pain rapidly increased, and erysipelas supervened. He died exactly three days after being stabbed. The *post mortem* examination showed much swelling of neck, extending over right side of chest also, and the skin had a livid appearance. On cutting into the swelling much blood was found, and inflammation products which had extended to the right lung, which also was much inflamed and adherent to the ribs by means of bands of lymph. The spleen was enlarged." The "three small black substances" were examined by Dr. Center, who recognized a part of *abrus* seed as used in cattle-poisoning, and microscopically their structure was found to agree with those of *rati* (jequirity) seeds. On insertion below the skin of a dog, the animal died in 50 hours, and on *post mortem* examination diffuse inflammation wound puncture was found.—Dr. Center, *Panjab Chem. Ex. Rept.*, 1873.

Cases.—**Homicidal Abrus poisoning.**—In 1871, in Bengal a man was murdered by a *sutāri* being driven into his side; lately another man was wounded by a *sutāri* while asleep, and died from "lock-jaw"; a third man was wounded with a *sutāri*, but escaped death by the affected part being excised. This man's cousin, however, died from the effects of a *sutāri* being driven into his cheek (see *Case* above). *Beng. Police Rept.*, 1871. (*d*) and (*e*) One case of homicidal abrus "*sui*" poisoning was reported in the Panjab in 1893, and another in 1899, in addition to that in 1873 (see *Case* above). (*c*) The Civil Surgeon, Muzaffargarh, forwarded a case in which it appeared that death had occurred in a Mohammedan male, aged 30 years, from "needle" or "*sui*" poisoning. On *post mortem* examination there was a sloughing wound on the right side of the neck, with œdema and inflammation extending from the right ear downwards over the neck, chest, and abdomen. Death is said to have occurred on the fifth day after receipt of the injury. No foreign body was found in the wound, but two sharp conical "needles" forwarded along with the viscera were found to consist of pounded "*rati*" seeds (*Abrus precatorius*). Maj. Black, *Panjab Chem. Ex. Rept.*, 1916.

CHAPTER XXVII.

ANIMAL IRRITANT POISONS.

THESE may be divided into (1) poisons secreted by living animals, (2) poisons generated by dead animal tissue, including food-poisoning.

POISONS SECRETED BY LIVING ANIMALS.

SNAKE VENOMS.

Death from snake-bite is usually *accidental.* From 15,000 to 20,000[1] deaths are annually reported in India as being due to 'Snake-bite,' but there is no doubt that this alleged cause of death conceals some undiscovered crime. Cases of undoubted murder by hanging, strangulation, abortion, etc., have been found to be conveniently reported as 'Death by snake-bite.' It is desirable, therefore, that the bodies of persons alleged to have died from snake-bite should be sent by magistrates, whenever possible, for examination by the civil surgeon or other medical officer.[2]

In 1900 the reported mortality from snake-bite in India was no less than 22,393 deaths, namely, in Madras Presidency, 2037; in Bengal, 10,557; in Bombay, 701; in N.-W. P. & Oudh, 6,056; in Panjab, 893; in Burma, 874; in Central Provinces, 994; in Assam, 170; in Coorg, 1; in Berars, 104; in Ajmere-Merwara, 4; in Bangalore, 2.

Homicide by snake-bite has not been reported of late years; but cases of cattle thus poisoned are reported (see p. 601); and many of the native quack-doctors keep dried cobra-venom as a remedy.[3] So that it may occasionally be used for

[1] This death-rate is over 100 per million, ranging from about 45 per million in the Panjab to about 130 per million in Bengal. In one district of Bengal, namely, Burdwan, the snake-bite death-rate was 173 per million as the average of the 10 years ending 1869.

[2] A non-poisonous snake may be sent as evidence of the alleged bite with the body of a person who has been murdered otherwise.

[3] In a case of poisoning in Calcutta in 1884, amongst the suspected articles sent me for examination from the house of the accused was a gummy mass of

homicidal purposes though undiscovered. The crime of using snakes for murder is mentioned in Hindu and Mohammedan law; and formerly criminals in India were sometimes executed by snake-bite.

In Hindu law it was enacted that "if a man by violence throws into another person's house a snake or any other animal of that kind, whose bite or sting is mortal, this is *Shahesh, i.e.* violence. The magistrate shall fine him 500 puns of cowries and make him throw away the snake with his own hand." Halhed's *Code of Gentoo Law*, pp. 262, 263. Mohammedan law strangely provided that "if a person bring another into his house, and put a wild beast into the room with him, and shut the door upon them, and the beast kill the man, neither *kisas* nor *diyat* is incurred; *and it is the same if a snake or scorpion* be put into the house with a man, or if they were there before and sting him to death. But if the sufferer be a child, the price of blood is payable" (quoted by Chevers, *M.*, 381). An execution by snake-bite is thus described by Terry of Sir Thomas Roe's suite: "There was another condemned to die by the Mogul himself (while we were at Amadavar) for killing his own mother, and at this the king was much troubled to think of a death suitable for so horrid a crime; but upon a little pause he adjudged him to be stung to death by snakes, which was accordingly done. There were some mountebanks there which keep great snakes to show tricks with them; one of these fellows was presently called to bring his snakes to do that execution, who came to the place where that wretched creature was appointed to die, and found him there all naked (except a little covering before) and trembling. Then suddenly the mountebank (having first angered and provoked the venomous creatures) put one of them to his thigh, which presently entwined itself about that part, till it came to his groin, and there it bit him till the blood followed, the other was fastened to the outside of his other thigh twining about it, and there bit him likewise. Notwithstanding, the wretch kept on his feet for near a quarter of an hour, before which time the snakes were taken from him; but he complained exceedingly of a fire that with much torment had possessed all his limbs, and his whole body began to swell exceedingly. . . . About half an hour after they were taken from him, the soul of that unnatural monster left his growing carcase."

There are also the classic instances of the employment of snakes in war by Hannibal and Antiochus defeating the Romans in a naval action by throwing earthen pots filled with serpents

dried cobra venom weighing over 100 grains.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884.

into their ships, and similar episodes are related of the Saracens; and in respect to *suicidal* use there is the story of Cleopatra and others.

Case.—**Homicide by snake-bite.**—In this case, two snake charmers were convicted at Purneah, Bengal, in 1869, of causing the death by snake-bite of three men. The prisoners, it was proved, partly by threats, and partly by assurances that it was in their power to prevent ill effects following, induced four men to allow themselves to be bitten by a krait. All four were poisoned, one only recovering. What the motive for the crime was did not appear.—Fayrer's *Thanatophidia of India*, p. 51.

The popular division of snakes into poisonous (or venomous) and non-poisonous, although not strictly correct scientifically, may be adopted here for toxicological purposes. Poisonous snakes, of which many species are known within Indian limits, belong to one or other of two families, namely, the (1) *Colubridæ* and (2) Vipers or *Viperidæ*. All vipers are poisonous, but only two sub-families of colubrine snakes are decidedly poisonous, namely, *Elapinæ*, and the sea-snakes (*Hydrophidæ*). Poisonous snakes are distinguished from non-poisonous by the presence of poison-glands. The poison-gland is usually situated one on each side of head above the upper-jaw and behind the eye, and it communicates by a duct with the poison-fangs, which are enlarged, channelled or 'perforated' teeth of the anterior maxilla. There is no sure way of distinguishing a poisonous from a harmless snake by external characters except by the dentition—the presence of grooved teeth—and an intimate knowledge of the various genera, and their head shields and scales, for which the zoological text-books should be consulted.[1]

The chief points of distinction between the two families of poisonous snakes are roughly:—

Poisonous colubrine snakes.	Vipers.
1. Body usually long and cylindrical	Body usually short with narrow neck
2. Head small, seldom broader than body, covered by large scales or shields of special form or number	Head large, broader than body, triangular and covered by numerous small scales usually
3. Maxillary bone carries other teeth beside poison fang	Maxillary bone carries only poison fang
4. Eye has round pupil	Eye has vertically elliptic pupil

[1] Boulenger's *Reptilia*, Fauna of British India, 1890, or Fayrer's *Thanatophidia of India*, or Ewart's abstract of the latter; or Major F. Wall's (I.M.S.) excellent practical manual, *The Poisonous Terrestrial Snakes of British India*, Bombay, 1908.

The chief poisonous species of Indian land snakes are the following; the most common deadly ones are marked * *, the less common deadly ones *:—

COLUBRINE—

** **Cobra**, *Naia tripudians*. Vern.—'*Nāga*,' *Keautia*, '*Kāla Sānp*,' '*Gehusānp*.' Throughout India and up Himilayas to 8000 feet	Hooded elapine.
* **Hamadryad** or 'Tree-Cobra,' or 'King-Cobra,' *Naia-bungarus* or *Ophiophagus elaps*. Vern.—*Sankerchor*. From Lower Bengal, southwards through India, Assam, and Burma, attaining a length of 15 feet	
** Blue Krait, *Bungarus cœruleus*, attaining 4½ feet	Non-hooded elapine.
* Banded Krait, *Bungarus fasciatus*. Vern.—'*Sankni*,' or *Raj-sānp*,[1] growing to 6 feet or more	

VIPERINE.—These are divided into 'vipers proper,' *Viperinæ*, and the 'pit-vipers' or *Crotalinæ*, the latter having a deep pit on each side of the snout between the eye and the nostril, and are confined to the hilly regions. The chief species are:—

** Russell's Viper, or the Chain-Viper. *Vipera russelli* or *Daboia russelli*. Vern.—'*Bora*,' '*Ticpolonga*,' '*Gunus*,' growing to 5½ feet	Viperine.
* Keel-scaled Viper, *Echis-carinata*. Vern.—'*Fursa*' *Afæ*, or *Kapar*, attaining a length of about 2 feet	
Trimeresurus, several species, terrestrial and arboreal	Crotaline.
Ancistrodon hypnale or *Hypnale nepa*. Vern.—'*Karawala*' in Ceylon and W. Ghats, south of Bombay, and *A. himalayanus* from Sikkim to N.-W.	

The cobra, hamadyrad, and daboia are the most deadly of all snakes. After the cobra the great Russell's viper is the most deadly of Indian snakes, next comes the blue *Krait*, the little viper *Echis c.* (with a dart-shaped whitish dark-edged mark on head), the great banded (blue and yellow) *Krait* (often confounded with the harmless *Lycodon fasciatus* of Assam and Burma), which is not very virulently poisonous, so little so that its bite is believed often to be *non*-fatal. The bite of the species of *callophis, trimeresurus*, and *ancistrodon* does not usually produce death in adult human beings and large animals.

Physical and chemical characters of snake-venoms.—The physical characters and chemical composition of snake-venom differs to some extent according to the species and family to which the snake belongs. The venom of the cobra when freshly ejected is a light amber-coloured liquid like clear varnish of a specific gravity of about 1·046 and feebly acid reaction. It dries rapidly in the air into a yellowish film, like gum arabic, which tends to split up into bright yellowish scales

[1] In Assam *B. lividus*, in Ceylon *B. ceylonicus*, in Sikkim *B. niger*, and E. of Sikkim *B. bungaroides*.

and granules. This yellow powder has an acrid odour and is an irritant to mucous membranes. It is soluble in water, the solution becoming actively toxic. The dried venom retains its activity for several years, and may be heated up to 100° to 125° without losing its poisonous properties. In 1883 Dr. Weir Mitchell showed that rattlesnake-venom could be split up by dialysis, etc., into two toxic principles, a peptone (albumose ?) and a globulin, each with different properties; and he considered that differences in the action of snake-venom of different species of snakes depends upon the relative properties of these two substances. Norris Wolfenden applied this discovery to the venom of the cobra and Indian vipers, differentiating out several active constituents with different poisonous properties.

Action and symptoms of snake-venom.—The physiological effects of snake-venom differ to a considerable extent in kind according to the species or family to which the snake belongs. The broad differences between the symptoms of poisoning by the colubrine cobra and the vipers were described by the early Indian observers, especially Dr. P. Russell, Sir Joseph Fayrer, Dr. Wall,[1] and Dr. V. Richards. Their experiments were of a somewhat crude kind, the animals experimented upon usually receiving their poison by a bite from the snake, a method open to many fallacies. The more precise method of experiment by means of hypodermic injection of a measured quantity of fresh venom of ascertained strength and activity into a series of animals of given weights, and verified by control experiments, and *post mortem* examination was first employed in India by Dr. L. A. Waddell, in a large series of observations conducted at his own expense, with the result of indicating the remedial treatment of snake-bite by inoculation.[2] In the then absence of research laboratories in India the further researches on exact modern lines into the essential nature of cobra and Indian viper venom were a few years afterwards prosecuted in Europe with dried venom, notably by Lauder Brunton, Norris Wolfenden, Fraser, and latterly Calmette.

Snake-venom of both colubrine snakes and vipers has a local as well as a remote action. Locally it acts as an irritant to the tissues, and hence, when introduced into a wound, causes immediate burning pain in the wounded part, followed by swelling and inflammation. Even when applied to thin unabraded membranes such as the conjunctiva, it acts as a local irritant.

[1] *Proc. Roy. Soc.*, 1881, Vol. XXXII., p. 333.

[2] *The Effect of Serpent-Venom, Sc. Mem. Medl. Offrs.*, IV., India, Calcutta, 1889. See also pp. 587–8.

Its remote action is exerted mainly either on the nervous system, or on the blood, or on both; and may not only be the result of its absorption into the system from a wound, but may even result from its absorption through unabraded delicate membranes, such as the mucous membrane of the stomach.[1] The remote action of the poison of the cobra and other colubrine snakes and including sea-snakes,[2] seems usually to be mainly exerted on the nervous system, whilst that of the Indian vipers is especially upon the blood. These two classes of effects are attributed by Weir Mitchell respectively to the toxic *peptone* which acts more particularly on the tissues, causing inflammatory action with much swelling and extravasation of blood, whilst the globulin acts more particularly on the nervous system, paralyzing the heart and the respiratory centres.

Action on the nervous system.—An interval varying in duration usually elapses between the bite of a poisonous snake, and first appearance of nervous symptoms. In the human subject, this interval in cases of cobra-bite may be 15 minutes to about an hour, which is the average according to Wall,[3] but may be longer; it is often longer in cases of bite by the less venomous snakes. In cobra-bite in the human subject (see *Case*, p. 597) the chief nervous symptoms are a feeling of intoxication, followed by loss of power in the legs, the patient staggering or falling if he attempts to walk or stand.[4] The loss of power then spreads to other muscles, those of the tongue and larynx becoming early affected, and the powers of speech and deglutition are lost, the saliva trickles away, the power of expelling it having ceased, as in glosso-pharyngeal paralysis. The paralysis then becomes general, the respiration slow, and it becomes weaker and weaker till death occurs by asphyxia, due to gradual paralysis of the respiratory movements and the heart beating for some time after the respirations have ceased. Nausea and vomiting are often early symptoms, and asphyxial tremors (not convulsions, as the general paralysis precludes these) may precede death. The pupil, as a rule, is but little affected. Death seldom occurs before 20 minutes to half an hour, even when the largest doses are given. Very similar nervous symptoms usually follow the bite of other colubrine

[1] *Thanatophidia of India*, p. 64; L. A. Waddell in *Sc. Mem. Med. Offrs.*, IV., p. 26.

[2] For exhaustive experiments on the venom of sea-snakes, see *Physiological Action of the Poison of the Hydrophidæ*, by L. Rogers, M.D., I.M.S., *Proc. Roy. Soc.*, 7th May, 1903, and reproduced in *Ind. Med. Gaz.*, pp. 269, etc., 1903.

[3] On *Indian Snake Poisons*, p. 12.

[4] Lauder Brunton considers that the terminations of the motor nerves are affected.—*Proc. Roy. Soc.*, 1875, Vol. 23.

snakes, but as the poison is less active more chronic symptoms may develop.

Thus, Wall, in experimenting upon animals with the poison of *Bungarus faciatus*, found that in some cases symptoms were caused by it exactly resembling those seen in cobra-bite, while in others the first effects of the poison on the nervous system were slight, and soon passed off, but, after an interval of two to five days, were followed by a fresh set of constitutional symptoms. The animal became weak, purulent discharges took place from the eyes, nose, and rectum, the urine became albuminous, and death occurred from exhaustion several days after the bite. In these cases, however, there was no tendency to hæmorrhage.

Daboia-bite also causes marked nervous symptoms, but the paralysis is more general, does not specially affect the tongue and larynx, and salivation is, as a rule, absent. Convulsions are often present early in the case, and the pupil is usually dilated. In **Echis-bite** the nervous symptoms are, as a rule, comparatively slight in severity. *Mental shock* may, to some extent, modify the nervous symptoms present in a case of snake bite; and from recorded cases it appears that the bite of a non-poisonous snake may give rise to mental shock so severe as to cause death.

Action on the blood in viper-poisoning.—Martin of Melbourne has shown that the very rapid deaths are due to an extensive intravascular thrombosis, especially of the pulmonary arteries, and this has been confirmed by Weir Mitchell in regard to the American vipers—the rattlesnakes. It has, moreover, been directly observed with respect to the great Indian viper, the Daboia, by Captain G. Lamb.[1] This intravascular thrombosis in the pulmonary arteries explains the leading symptoms in the rapidly fatal cases, namely, the gasping with quickened and laboured respiratory movement and violent convulsions soon ending in death.

In the less immediately fatal cases of viper-poisoning the most striking characteristic of the blood is that it has completely lost its power of coagulating, and this condition seems to account for the large bloody extravasation and œdema and bloody oozing at the site of bite, the extensive hæmorrhages from mucous membranes, ecchymotic patches, and œdemas which are such prominent symptoms of the more chronic cases of viper-poisoning.

Cobra-poison in laboratory experiments causes active hæmolysis and delays the blood from clotting. The poison dissolves out the hæmoglobin from the red corpuscles, but the poisoning danger as a rule ceases with the disappearance of the

[1] *Ind. Med. Gaz.*, 1901, p. 444.

nervous symptoms, whereas, with vipers, the blood-poisoning symptoms may continue for days after the nervous symptoms have disappeared, may end in death from exhaustion, and in echis poisoning are often the chief symptoms present. Further, owing to this special tendency to blood-poisoning, danger to life in cases of daboia and echis-bite may continue long after the nervous symptoms have been recovered from; while in colubrine snake-poisoning, danger as a rule ceases with the disappearance of the nervous symptoms.

Case.—**Cobra-bite**—accidental.—A coolie was bitten on the shoulder by a cobra about midnight. He immediately felt a burning pain at the spot bitten, which increased. In 15 minutes afterwards he began, he said, to feel intoxicated, but he seemed rational and answered questions intelligently. The pupils were natural, and pulse and respirations normal. He next began to lose power in his legs and staggered. In 30 minutes after bite his lower jaw began to fall, and frothy viscid saliva ran from his mouth. He spoke indistinctly, and the paralysis of the legs increased. Forty minutes after the bite he began to moan and shake his head from side to side, and the pulse and respirations were somewhat accelerated, but he was still conscious and able to answer questions. There was no paralysis of the arms. The breathing became slower and slower, and at length ceased one hour and ten minutes after the bite, the heart beating for about a minute after the respiration had stopped.

Case.—**Russell's viper-bite**—chronic.—A Mohammedan, aged 40, was bitten on the finger by a *Daboia*. The bitten part was excised soon after, and stimulants given. The hand and arm became much swollen, and on the same day he passed blood by the rectum and bloody urine. The next day he was sick, and still passing blood from both channels. In this state he remained eight days, constantly losing blood, and died on the ninth day.—*Ind. Med. Gaz.*, June, 1872.

Post-Mortem Appearances in Snake-Bite.—For the medical jurist the chief practical point is how to recognize snake-poisoning *post mortem*. Endeavour should be made to distinguish between Colubrine and Viperine cases. In Colubrine cases, Cobra or Krait, there is seldom much to indicate the site of the puncture. In some cases you may fail to find it. The blood is generally fluid and hæmolysed, causing early staining of the vessels. There is very little definite to indicate the cause of the death.

In Viperine cases, Daboia or Echis, there is generally much discoloration, swelling, and infiltration, at the seat of the bite, and extensive cellulitis in its neighbourhood. Though the blood is usually found clotted in small animals, all autopsies in man have shown the blood fluid. There is often evidence of hæmorrhage into the bowel, purpuric spots on the pericardium and hæmorrhages may be found in many tissues.

Antidotes and treatment of snake-bite.—The appalling loss of life and the horribly sudden nature of the death from

snake-bite has always stimulated a search for antidotes. Of the many so-called 'antidotes' to snake-venom, however, permanganate of potassium was the only one that could be said to be of any use whatever, but even it is no true antidote, as it only destroys the venom when it actually comes into direct contact with it, and is powerless to counteract the poison once the latter has entered the circulation.

In 1888, as a result of a large series of experiments upon Indian serpents, undertaken expressly "to afford indications for combating the action of the venom on man," Dr. L. A. Waddell established the hypothesis that "immunity may be acquired by the imbibition of small doses of the venom," [1] and in support of this view he instanced the then newly discovered (but still unformulated) doctrine of antitoxins, as demonstrated by Dr. Wooldridge in regard to anthrax protection,[2] in these words:— "The protection conferred by 'vaccine' being, it is alleged, attributable, in certain cases, to the action of the soluble chemical products resulting from the growth and development of the morbid germ." [3] In reviewing Dr. Waddell's monograph the *Pioneer* on the 2nd April, 1889, in a long article said:— "Dr. Waddell propounds the theory that it is because the immunity is an acquired condition—a *toleration* to the venom established through the imbibition of small quantities of the venom . . . in other words, that the snake inoculates itself against the consequence of its own virus. And if the snake, why not the man; for that is the conclusion evidently to which Dr. Waddell means to work up. . . . Though after all it is a question whether it would be worth while for every one in India to be inoculated against the offchance of being bitten by a snake." Amongst the notices in European scientific journals of this research by Dr. Waddell on the artificial immunization against snake-venom, Professor Henry de Varigny gave an editorial notice of two columns in the *Revue Scientifique* of 22nd February, 1890, calling attention to its great practical import for India and other tropical countries, as a life-saving measure.

Dr. Waddell in concluding that monograph stated [4] that he was about to submit his hypothesis with the antitoxin features to actual experiment. Circumstances, however, prevented his doing this himself, owing to no facilities whatever having been given him for this work by the Government; but over five

[1] *An Inquiry into the Effect of Serpent-venom, etc., Sc. Mem. Medl. Offrs.*, IV., 1889; also *Ind. Med. Gaz.*, May, 1899, p. 147. See also review in *Pioneer*, 2nd April, 1889; and in *Revue Scientifique*, Paris, 22nd February, 1890.
[2] *Proc. Roy. Soc.*, 1887, p. 313. [3] *Op. cit.*, p. 27.
[4] *Op. cit.*, p. 28.

years later, M. Calmette[1] and Professor Fraser carried out the necessary experiments, after the antitoxin theory had become much more developed; and the protective antitoxin for snake-venom thus obtained is called 'Serum Antivenimeux' or 'antivenene.' It is the serum of the blood of animal (usually a horse) which has been rendered immune against serpent venom by repeated injections of the venom.

This 'antivenene' seems to have undoubted antidotal properties for cobra-bite, as it is prepared for cobra-venom. It has, however, little if any value against viper-venom, which has been shown by Wall, Richards, Waddell, Wolfenden and Martin to have a different chemical composition and physiological action from cobra-venom; and Cunningham in 1896 by direct experiment found that "the antidotal material (antivenene) contained in the blood of animals which have been artificially immunized against colubrine (cobra) venom is inert against viperine venom, and *vice versâ*."[2] Latterly in the production of antivenomous serum a mixture of colubrine and viperine poison is used in the proportion of 80 of the former to 20 of the latter; and a supply of this new serum is now issued to every civil station and regiment throughout India. It rapidly deteriorates.[3]

The **local treatment,** however, should never be neglected, namely, the immediate sucking of the wound, ligaturing the limb above the bite and applying freely an alkaline solution of permanganate of potassium with free scarification, excision of bitten tissue, and laying open the wound so that it bleeds freely—this last perhaps is the most important of all. And if the severer symptoms set in, an attempt to maintain breathing should be made by artificial respiration and galvanism.

The **permanganate** treatment is adversely reported on by the authoritative experimenters Lamb and Bannerman. The latter writes (*I.G.M.* 1912, 381, etc.):

The treatment of snake-bite by potassium permanganate was first used by Sir Joseph Fayrer, I.M.S., in 1869, who found that the drug "did not seem to have any power to avert the lethal action of the poison." Wynter Blyth showed that when mixed *in vitro* with permanganate of potassium, cobra venom became innocuous. In 1881 Couty and Lacerda performed certain experiments, showing that the lethal action of serpent's venom was destroyed when a 1 per cent. solution of the drug was injected into the tissues close to the place of bite. In

[1] Calmette's announcement was first made in February, 1894.
[2] *British Med. Jur.*, 15th June, 1895; *Sc. Memoirs*, IX., pp. 1–30.
[3] G. Lamb, I.M.S.; *ib.*, N.S., p. 11, 1902.

1902 Lauder Brunton introduced the well-known "lancet," in the hope that in this simple method lay a treatment for snake-bite which would be of great life-saving value. Rogers reported promising results from experiments on various animals. Lamb, on the contrary, conducted experiments which were not successful. The present investigation was instituted to obtain evidence as to the efficacy of the treatment *in vivo*.

It was decided that in the first series of experiments natural conditions of biting should be imitated as closely as possible. The test dose was that given by the actual bite of the Cobra or Daboia, and it is to be noted that the Cobra, after having bitten, remains attached to his prey for an appreciable time, whilst the Daboia darts with incredible rapidity, and then releases its victim instantly. The latter snake occasionally fails altogether in its strike.

Dr. Bannerman's experiments showed that—

(1) A dog bitten by a cobra cannot be saved by the local application of powdered potassium permanganate rubbed in after free incision of the bitten place; nor by a similar application of a solution of the powder.

(2) That it may be saved by the immediate subcutaneous injection of 10 c.c. of a 5 per cent. solution of the drug; but that this solution is so strong as to act as an escharotic.

(3) That if this treatment be delayed for even two minutes, it loses its efficacy.

(4) That a dog bitten under natural conditions by a Russell's viper (Daboia) cannot be saved by the drug, however applied.

"The conclusions as to the action of potassium permanganate powder on small doses of cobra venom injected *just under the skin* appear to be that this treatment is of some little use under these highly artificial conditions. It must be remembered, however, that a snake does not deposit its venom under the skin, but striking as it does with its fangs at right angles to the skin, the poison must usually be placed well below the fascia of the part, and therefore further removed from the applications of a chemical antidote." "With regard to Daboia venom injected just under the skin, the results are very similar to those obtained with the venom of the cobra, *i.e.* that under such artificial conditions the treatment by free incision and rubbing with powder of potassium permanganate is of some little use. As a practical measure for employment after actual snake-bite it appears to be of no use whatever."

Should the situation of the bite permit, at once apply a ligature above the bitten part. Wall strongly recommends that this should be a thick indiarubber cord or band, wound

several times tightly round the limb.[1] Failing this, two or three ligatures, at intervals of a few inches apart, should be, as recommended by Fayrer, tied round the limb, and the one nearest the bite tightened by twisting with a stick. Then using, if necessary, a lens, examine the part supposed to have been bitten. Usually two scratches, short cuts, or punctures, under one inch apart, will be found. Sometimes the punctures are very minute and barely visible, a drop or two of blood or serum indicating their position. The situation of the poisoned wound having been made out, free excision should at once be resorted to. The excision should include not only a portion of the skin about one and a half inches square, but also the underlying tissues for some little depth. As recommended by Wall, the areolar tissue below and around the excised portion of the skin should be dissected away freely, and on parts into which, from their situation, the fangs are able to sink in deeply, the excision should be carried still further. Thus, on the fingers or toes, the soft parts should be excised down to the bone, or the finger or toe amputated; and if the bite is on the ball of the thumb, the fascia and a portion of the muscle should be included. After excision, the wound should be washed with solution of caustic potash or potassium permanganate, and the ligature removed. The subsequent treatment may consist of the administration of stimulants, the employment of cold affusion, the use of artificial respiration (if there is a tendency to asphyxia), and general treatment of the symptoms as they arise. Main reliance must, however, be placed on early and free excision.[2]

Cattle-poisoning by snake-venom.—The cattle of villagers are occasionally criminally poisoned by skin-workers for the sake of their hides. Snake-venom has been found by Hankin, in several cases, on pieces of rags taken from the rectum of dead cattle, in the United Provinces. It is stated that a cobra is placed in an earthen vessel with a banana. Heat is applied

[1] Wall points out that after an incision has been made through the skin examination of the parts below will reveal to an experienced eye if injection of venom has taken place; and that any signs of irritation indicative of the wound being something more than a mere mechanical puncture, should be taken as showing that the individual has been poisoned as well as bitten.

[2] Several chemical substances, *e.g.* potassium permanganate, destroy the activity of snake-poison if mixed with it previous to its introduction into the body. These, however, only do so owing to their general action on organic matter. Hence, once the poison has been introduced into a wound, these substances, owing to their having no special affinity for the poison, are practically useless as remedial agents. So also are the so-called snakestones, *i.e.* stones which are reputed to have the power of sucking out the poison when applied to the wounded part.

to the vessel. The snake being irritated bites the banana. The banana is then taken out and crushed to a pulp which is spread on a piece of rag. The rag is inserted into the rectum of an animal by means of a piece of split bamboo. In some cases after the death of the animal snake poison can be detected on the rag by means of the test described in the following paragraph. The juice of madar (*Calotropis gigantea*) appears occasionally to be used in a similar way instead of snake-venom.

Test for snake-venom.—A small quantity of the watery solution or extract from a suspected rag, etc., sufficient to kill, should be injected into two fowls or rabbits, a different dose in each, and the same quantities mixed with antivenene, in which latter case the animals operated on should remain unaffected.

Venomous Insects.

Scorpions.—These have in the last joint of the tail a hollow sting, communicating with a poison-secreting apparatus, and serving, like the poison fang in snakes, to convey venom into wounds made by it. The local irritant action of the venom is always very severe. Five children died from scorpion sting in Bengal during the three years ending 1872; and from cases quoted by Chevers it would appear that the sting, at any rate of the larger varieties, may cause death in adults. The darker variety is said to be more deadly. **Centipedes and spiders** are also provided with a poison-injecting apparatus connected with their jaws or mandibles. The bites of these cause effects very similar to those produced by the sting of a scorpion. The bite of some varieties of spider appears to cause severe constitutional symptoms, and may even cause death. **Wasps, bees and hornets** are all provided with a poison sting. A single sting from one of these is not likely to cause serious effects, except in cases where it goes directly into a vein, or where inflammation and swelling of the part stung interferes with some important function, *e.g.* respiration. Taylor mentions, however, two cases in which adult females died from shock after, apparently, a single sting of respectively a wasp and a hornet. A number of stings, as in cases where persons are attacked by a swarm of wasps or bees, have frequently caused severe constitutional disturbance, occasionally ending in death. Lizards, contrary to the popular belief, at least those which, up to the present, have been met with in India, are not venomous.

Cantharides, the dried *Cantharis vesicatoria*, blister beetle, or 'Spanish fly,' applied to the skin, causes irritation and

vesication, and when swallowed or absorbed into the system in poisonous doses, gives rise to the usual symptoms of irritant poisoning, accompanied, when the poison has been taken by the mouth, by blistering of the mouth and throat. A case of cantharides poisoning by the vapour emitted from a bottle of hairwash containing cantharidine was reported by Dr. Islay B. Muirhead, of London, in 1906, in which a person occupying the same room, and who did not use the wash, was affected by the fumes. The evacuations usually contain blood. Special symptoms in poisoning by cantharides are: (*a*) salivation, with swelling of the salivary glands and back of the throat, rendering swallowing painful and difficult; and (*b*) strangury, hæmaturia, inflammation of the genitals and other similar symptoms, due to the special irritant action of the poison on the kidneys and urinary passages. In fatal cases convulsions generally precede death; insensibility may or may not be present. Cantharides is seldom administered with homicidal intent; cases of poisoning by it are usually accidental, or arise from its being given as an abortifacient, or as an aphrodisiac. As an abortifacient, cantharides often fails, but sometimes succeeds, owing to the violent constitutional disturbance produced. There is no proof that the drug has any specific action on the uterus. As regards aphrodisiac action, the drug may possibly excite sexual passion, but it is only likely to do so when given in quantity sufficient to endanger life or cause serious symptoms. Taylor[1] mentions an English case (*R.* v. *Wilkins*, Liverpool Lent Assizes (1861)) where a man was tried and convicted of administering powdered cantharides to a woman, in which the question arose whether or not an offence had been committed, seeing that the drug had been given solely with the motive of exciting sexual desire. Mayne, in his commentary on *s.* 328 of the *Indian Penal Code*, refers to this case as follows: "In a case under a similar English statute, where it appeared that the prisoner had administered a drug to a female with intent to excite her sexual passions, in order that he might have connection with her, the conviction was affirmed." Dose, etc.—The medicinal dose of powdered cantharides is one to two grains, and of the tincture (strength one to eighty) five to twenty minims. The smallest fatal doses recorded are of the powder, twenty-four grains; and of the tincture, one fluid ounce. Recovery has, however, taken place from six ounces of the tincture, and in another case from sixty grains of the powder. The shortest fatal period recorded is twenty-four hours, and the longest (from one ounce of the tincture) seventeen days. Taylor mentions a case where death, with the usual symptoms of cantharides poisoning,

[1] *Poisons*, p. 529.

resulted in five days, from the external application of cantharides ointment, in mistake for sulphur ointment, as a cure for itch. **Treatment.**—General. Oily demulcents should be avoided, as cantharidin, the active principle, is soluble in oil. Opiate injections into the bladder, opium suppositories, and warm baths should be used to relieve pain. *Post mortem* appearances.—These are usually signs of inflammation of the alimentary canal, congestion of the kidneys, and inflammation of the urinary passages. When the powder has been swallowed, glittering particles of it may be found adhering to the intestinal mucous membrane. Similar particles may be found in the vomited matters. **Detection.**—The powder is greyish-brown in colour, and contains shining, green, metallic-looking particles. These resist putrefaction, and may be detected in the contents of the intestines after long periods of interment. The active principle, cantharidin, present in the powder to the extent of about one-half per cent., may be extracted therefrom, or from organic mixtures containing it, by taking advantage of the fact that it is soluble in alkaline liquids, but can be removed from these by acidulating them, and shaking them with chloroform. On separating and evaporating the chloroform, cantharidin may be recognized in the residue by digesting this with a few drops of oil, and applying the liquid so obtained to the skin, when, if cantharidin is present, vesication will be produced. Cantharidin is also present in the *Mylabris cichorii*, or *Telini fly*, officinal in the I.P., as a substitute for cantharides, and possessing exactly the same action. The powder of these differs, however, from cantharides powder in containing no shining particles. Cantharidin has also been found in various other Indian blistering flies, *e.g.* in the *Mylabris pustulata* and *M. punctum*.

POISONS GENERATED BY DEAD ANIMAL TISSUES.

Poisonous Animal Food.

Poisoning by Putrid Meat.—An intoxication, with symptoms more or less resembling those of poisoning, may arise from eating meat which (1) contains ptomaines or toxalbumoses, (2) conveys a true infection by pathogenic bacteria, septic or from sewerage, etc., (3) is infested by gross parasites

(tape-worm, etc.), (4) is poisoned by metallic salts from imperfectly tinned cooking pots or zinc or copper vessels. It most commonly occurs from eating old preserved canned or tinned meat, and often from sausages, hence the term 'sausage-poisoning,' or Botulismus; but it also occurs from other stale tinned meats, and may also occur from vegetable food.[1] In the first two classes, besides the usual irritant symptoms, there is usually dryness of the skin and mucous membranes, and the narcotic symptoms of ptomaines, dilatation of the pupils, and paralysis of the upper eyelids. In cases where the symptoms do not develop for some time, but commence from 12 to 50 hours after the consumption of the tinned meat, they are due to bacteria, there is generally fever, the digestive troubles are more like those of gastro-enteritis, and sometimes there is blood in the evacuation, and there may be pleuro-pneumonia, as in the Middlesbrough epidemic of 1880, in which 490 persons died, and a pneumonia bacillus was isolated. Some of such meat when examined contains such a number of dead cocci and bacilli as to bear all the appearance of an artificial culture-broth. A *Bacillus botulinus* was found by Van Ermengen in a case of food-poisoning from raw ham, and a microbe like the *B. enteriditis* of Gaertner in the Bhowanipore epidemic of 1903 by Nield Cook.[2]

Cheese and milk.—In more than one case symptoms of irritant poisoning have been produced by eating cheese. In such cases the cheese eaten has generally, but not invariably, been found to be rancid and to contain *tyrotoxicon*, which is obtained as needle crystals by alkalizing and shaking with ether. It is not an alkaloid, but is considered by Vaughan to be diazobenzene and to be a product of micro-organism in the milk. In decayed cheese as well as in the milk of deceased cows a poisonous ptomaine or toxalbumose has been found.

Poisonous fish.—Many cases, a few of them ending fatally have been reported, in which persons have been attacked with symptoms of poisoning after eating fish, especially stale or tinned fish. In some of these cases the symptoms have appeared within a few minutes, in others not until twelve or twenty-four hours, or more, after eating the fish. One or both of two sets of symptoms may be present, viz. (1) the usual symptoms of irritant poisoning, and (2) swelling and inflammation of the

[1] An outbreak of severe diarrhœa in a Bengal jail was traced to the maize in the food.—W. J. Buchanan, I.M.S., in *Ind. Med. Gaz.*, 1900. And an attack of so-called cholera in Lord Hastings' camp in 1817 was attributed to unwholesome rice.—Chevers, *M. J.*, p. 301. But see *Bathyrism* and *Poisonous Food-grains*.

[2] *Ind. Med. Gaz.*, 1903, p. 362.

eyelids, with profuse lachrymation accompanied by irritation of the skin and appearance of an eruption resembling nettle-rash. In some cases muscular debility, numbness of the limbs, delirium, and coma have been observed. Death has occurred within the hour, and has been delayed until the ninth day.

Cases of fish poisoning may be divided into four classes:

(1) A peculiar **idiosyncrasy,** rendering the fish poisonous only to the individual attacked, and not to others; (2) fish usually non-poisonous, becoming poisonous to all, attributed (*a*) to the presence in the fish of copper; (*b*) to the fish being in spawn; (*c*) to the poisonous nature of food (*e.g.* acrid mollusca, or acrid spawn or sewage) eaten by the fish; (*d*) to the development of a poison by decay (see "Ptomaines," below), etc., etc. Cases of this kind are due to shell-fish, especially mussels and oysters, but have arisen from *hilsa*, herrings, eels, mackerel, etc. (3) Cases arising from eating fish, certain parts of which seem to be nearly always poisonous: *e.g.* (*a*) a case cited by Blyth which occurred at the Cape of Good Hope, in which two adults died within twenty minutes from eating the liver of the toad or ball-bladder (*diodon*);[1] and (*b*) a case reported by Dr. Collas, of Pondicherry,[2] where three persons were poisoned by eating the *Gobus criniger*, in eating which the native females take great care, in preparing them, to remove the head and intestines, and wash the fish thoroughly. (4) Putrid fish. The secretion of the skin glands of certain species of amphibia has been found to be poisonous. Blyth mentions that a poisonous alkaloid has been found in the skin secretions of the *Salamandra maculosa*, the *Triton cristatus*, or water salamander, and the common toad.

Ptomaines.

Ptomaines are chemical products of bacterial life in dead animal tissues, and as they are found by *post mortem* decomposition, they have been callod 'cadaveric alkaloids,' or ptomaines. The poisonous properties found sometimes to be possessed by certain articles of food, *e.g.* milk, cheese, sausages, etc., are in many cases the result of the development of poisonous ptomaines in the food, as has been already noted. It is, therefore, quite possible that in the body of an individual, who has died from some other cause than poisoning, there may on examination be found an alkaloid, which, when tested by administration to an animal, proves to be poisonous. Some of these ptomaines have been found to possess a physiological action similar to that possessed by certain vegetable alkaloids, *e.g.* strychnia and atropine (*ptomatropine*). No ptomaine, however, has as yet been discovered possessing all the exact chemical characters of vegetable alkaloids, which are capable of being identified by

[1] Blyth, *Poisons*, p. 447.

[2] Chevers, *Med. Jur.*, p. 299.

distinctive chemical reactions.[1] Hence, the objection that an alkaloid discovered in a case of supposed poisoning may be a ptomaine produced by decomposition after death, mainly applies to cases in which the vegetable alkaloid, supposed to have been discovered, is one which can only be recognized by its physiological action, though none have yet been found to possess the peculiar tingling sensation of aconitine when applied to the tongue.

Diseased Meat.

In cases of diseased meat, the disease may or may not consist in the presence of a parasite in the meat. The parasites, the presence of which in meat most commonly gives rise to cases, are the trichina spiralis and the various systicerci.

Trichina spiralis.—Meat affected by this parasite contains, lying among the muscular fibres, small oval sacs, just visible to the naked eye,[2] each containing a coiled-up trichina (see *Plate IV.*, fig. *b*). Sometimes these sacs are so numerous as to give the meat a white speckled appearance. When meat thus affected is eaten without having been thoroughly cooked, a train of symptoms known as trichinosis is produced.

The pathology of trichinosis is briefly as follows: the trichina, while enclosed in its cyst, is in a chrysalis condition. When the cysts are taken into the stomach or intestines of a warm-blooded animal, the trichina leaves the cyst and begins to produce young. Six to eight days after the ingestion of the cysts, these young trichinæ begin to leave the parent animal, and to migrate through the wall of the intestines into the muscles, where they, in their turn, become encysted, and live by preying on the muscular fibre. The symptoms of trichinosis resemble, to a certain extent, those of irritant poisoning, differing from an ordinary irritant case chiefly as follows: (1) there is generally a considerable interval, corresponding to the period of incubation

[1] A strychnine-like alkaloid has been obtained from a corpse (Mecke and Wimmer. *Pharm. Zeit.*). The alkaloid obtained forms white nodular crystals, its hydrochloride feathery tufts. It reacts like strychnine with picric acid, potassium dichromate, sulphuric and nitric acids, tannin, potassium ferricyanide, potassium thiocyanate, and after evaporating with chlorine-water it gives a dirty green with ammonia. With Fröhde's reagent it yields first a dirty violet, then an olive, and finally a green colour; with sulphuric acid a yellow, which changes to cherry-red, and then to rose; with Erdmann's reagent, a yellow colour. It is only slightly bitter to the taste, and has no physiological action on frogs.—*Treatment*, 1890.

[2] Taylor gives the measurement or the sacs as $\frac{1}{50}$th of an inch long by $\frac{1}{100}$th of an inch broad. The worm varies in length from $\frac{1}{50}$th to $\frac{1}{8}$ of an inch. As many as 6000 may be found in about sixteen grains of the affected meat.

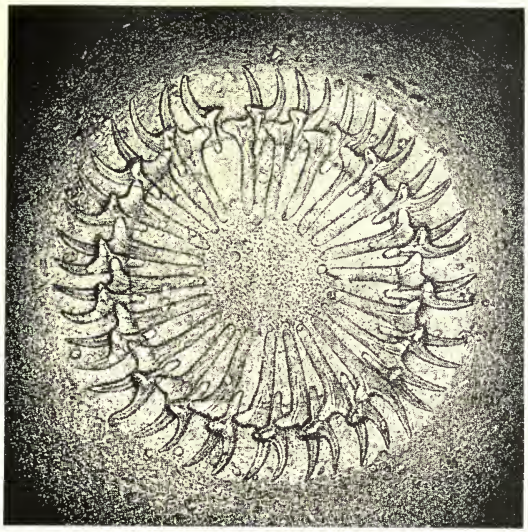
of the worm, between eating the food and full development of the symptoms. (2) Although the pain in trichinosis is intense, the vomiting and purging are not very severe; and the pain is not confined to the stomach and intestines, but extends to the muscles as well, owing to the invasion of these by the trichinæ. (3) In trichinosis, pneumonia is almost a constant symptom; there is often, also, peritonitis, and sometimes paralysis of the muscles. Several outbreaks of trichinosis have been reported, chiefly in Germany, the most notable being one which occurred, in 1863, in which 103 persons were attacked, of whom eighty died. There is no remedy, but it should be noted that trichinæ are destroyed by exposure for some time to the temperature of boiling water, and hence thorough cooking of trichinous meat prevents the occurrence of trichinosis. Trichinæ are more frequently found in the flesh of the pig than in that of any other animal, hence cases of trichinosis have generally occurred from eating imperfectly cooked pig's flesh in some form or other. In affected animals trichinæ, it is said, will always be found in the muscles of the eye.

Cysticeri.—These are the larvæ of tapeworms, and may be found in the flesh of all animals. Flesh containing them is popularly termed 'measly,' *e.g.* measly pork.

In affected meat the cysticerci are seen as little sacs, filled with fluid, embodied in the muscle. From one side of the interior of the sac a neck projects, terminating in a head surmounted with a crown of hooks (see *Plate VI.*, *a* and *b*). The pork cysticercus (*C. cellulosæ*) varies in size from a pea to a large bean, and develops into the *Tænia solium* (6 to 12 feet long). The cysticercus of ox flesh is smaller in size, and develops into the *T. mediocanellata* (15 to 20 feet or more). Both these tapeworms affect the human subject. In rare cases also, the larval form of *T. solium* has been found in the human body. Another variety of tapeworm, *T. echinococcus*, is only known to affect the dog and wolf; the larval form of this tapeworm, however, affects other animals, *e.g.* sheep, in which it specially affects the brain, causing 'staggers,' and the human subject, giving rise to hydatid tumours. Woodman and Tidy remark that *echinococcous* disease is alarmingly common in Iceland.

Other diseased meat.—The flesh of animals affected with disease not specifically parasitic in character may also, when eaten, give rise to symptoms resembling those of poisoning. Thus, Dr. Letheby met with a case in London in which sixty-four persons, of whom one died, were attacked with sickness. diarrhœa, and great prostration of strength, after eating

a



HOOKLETS OF CYSTICERCUS × 63.

b

HEAD OF CYSTICERCUS × 63.

(From Micro-Photographs by Dr. H. Gibbes.)

[*To face p.* 608.

sausages made from diseased beef. In another English case, which occurred at Welbeck, in 1880, over seventy persons, of whom four died, were attacked with similar symptoms after eating ham found, on examination, to contain a bacillus. In the great majority of the Welbeck cases of which particulars could be obtained, the symptoms did not appear until twelve hours or more after eating the affected food. A bacteriological examination should be made in such cases.

CHAPTER XXVIII.

NERVE POISONS.

THESE may for descriptive purposes be divided into cerebral, spinal, cerebro-spinal, cardiac, etc. (see Table, p. 448).

Cerebral Poisons, Opium, etc.

Generally the poisons of this order, including narcotics, anæsthetics, inebriants and deliriants, act mainly on the brain, causing one or other of two sets of symptoms or both. These, in the order of their occurrence, are: (1) Excitement with quick pulse and flushing of the face, often accompanied by delirium, and more or less derangement of voluntary movement; and (2) Sopor, deepening into more or less profound coma, with laboured and stertorous breathing.

The mydriatic deliriants produce the first of these two sets of symptoms, accompanied by dilatation of the pupils, as their prominent effect. The majority of poisons of this order—narcotic poisons—produce the second set of symptoms as their prominent effect. In poisoning by some of these, *e.g.* alcohol, a first stage of excitement and delirium usually precedes the second or comatose stage; but when the dose is large, this first stage may be absent. In others, *e.g.* opium, the first stage is commonly absent, or only slightly marked; but, if the dose is small, or the patient habituated to the action of the poison, a well-marked first stage may be present. A few, *e.g.* hydrocyanic acid and the poisonous cyanides, act with extreme rapidity, paralyzing the heart if the dose is large, and causing death by syncope; or in smaller doses, acting on the spinal cord as well as the brain, and although producing insensibility, quickly causing death by asphyxia due to paralysis of the muscles of respiration, and not by coma as is usual in cerebral poisoning.

No chemical antidote is available for the majority of these poisons, hence, in most cases, the treatment must consist in the use of measures directed to (*a*) procuring elimination of

the poison, and (*b*) counteracting its effects. If the poison, as is usually the case, has been administered by the mouth, the first of these indications may be carried out by giving emetics or using the stomach-pump; the latter being resorted to in preference to repetition of the emetic, seeing that many of these, *e.g.* zinc sulphate, if not ejected by vomiting, are liable to become absorbed and act as poisons. The measures by which the second indication of treatment may be carried out vary according to the poison and the prominent symptoms. Thus, cold effusions, keeping the patient roused, sinapisms, etc., are indicated when narcotism has to be overcome; and galvanism and artificial respiration when death threatens to occur by asphyxia. In the case of some cerebral poisons, special physiological antidotes are indicated, *e.g.* atropia in opium poisoning.

Opium and Morphine.

Opium, *Afim, Afiyún* (Hind.), is the inspissated juice obtained by incision from the unripe capsules of the poppy, *Papaver somniferum*, N.O. *Papaveraceæ*. It contains meconic acid and a number of alkaloids, those present in largest quantity being narcotine and morphine.

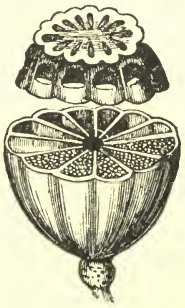


Fig. 51.—Capsule of Opium Poppy. (½ natural size.)

Indian opium, as a rule, contains more narcotine than morphine. Other varieties, as a rule, contain more morphine than narcotine. Of these two alkaloids, narcotine has no narcotic properties, and is officinal I.P. as a tonic and antiperiodic. Morphine, on the other hand, is a powerful narcotic. The percentage of morphine in different samples of opium varies from about 2½ to 15 or even 20 per cent. Indian opium often contains under 5, and seldom contains over 9 per cent. of morphine. Other alkaloids present in opium, *e.g.* codeine, narceine, and papaverine, also possesses narcotic properties. Another alkaloid, thebaia, the proportion of which in opium varies, seldom, however, exceeding 1 per cent., is a convulsant like strychnia, but less powerful.

Opium is so easily obtained everywhere in India and by its means the 'thin spun life' can be slit with such ease and freedom from physical suffering that, after strangulation, it is the most favourite means of suicide. In suicidal cases the opium is often mixed with mustard-oil in the belief that the latter facilitates the speedy action of the opium.

Of cases of poisoning in India, nearly 40 per cent. of the deaths reported to the chemical examiners are due to opium. Such cases in adults are, as a rule, suicidal, and these are mainly

amongst women, chiefly mistresses or demi-monde, deserted by their lovers, though a considerable number are 'failed' students. Homicide for the reasons already given is rather rare by opium. In very young children suicide is, of course, excluded, and cases are either accidental or homicidal. The practice of drugging young children with opium by ayahs and nurses, in order to keep them quiet, is widely prevalent in India, and often results in cases of the first description. So also, but less directly, does the habit of opium eating, cases being often reported in which children, getting hold of the box in which the opium is kept by their parents, eat a quantity and die. Poisoning by opium is a somewhat common method of infanticide in India.[1]

In England, according to statistics collected by Blyth, in the five years ending 1880, altogether 1581 deaths were reported from poison. Of these, 643, or 40·7 per cent., were due to opiates. Of the 643 deaths, 160 occurred in infants; two of these were cases of homicide. Of the adult cases, none were homicidal, and about 27 per cent. suicidal. In England drugging with opium is occasionally adopted for the purpose of facilitating robbery; it is seldom, if ever, used for this purpose in India, its place being taken by datura.

Symptoms.—When solid opium has been swallowed, there is usually an interval of half an hour to an hour before the symptoms appear. A shorter interval than this is sometimes observed, especially when the drug has been taken in solution on a nearly empty stomach. In other cases, the interval has been several hours in duration. Intoxication appears frequently to delay the appearance of the symptoms; but in one exceptional case, reported by Christison, the appearance of the symptoms was delayed for eighteen hours without any apparent cause. At first there may be slight excitement, this, however, is soon followed by giddiness and drowsiness succeeded by sopor, gradually deepening into coma, with low stertorous respiration. The breathing gets more and more shallow, and finally death occurs, usually from paralysis of the respiratory muscles. The face is usually pale, the lips livid, and the skin bathed in perspiration. All the secretions (that of the skin excepted) are more or less completely suspended. The pulse may be at first natural or quickened; afterwards it is usually slow, but becomes small, quick, and irregular as death approaches. An odour of opium may be present in the breath. The pupils are contracted and insensible to light, but towards the end become widely dilated.

[1] *Beng. Medico-legal Rept.* for 1870–72 states that, in the three years ending 1872, thirty cases of infanticide by opium poisoning were reported, and in addition thirty-seven cases of alleged infanticide by poison, of which the majority were probably opium cases. For recent statistics see *Appendix IX.*

Rare symptoms.—*Vomiting* and even *diarrhœa* are sometimes present. Tetanoid convulsions and lockjaw have been observed, more particularly in children, and when morphine has been taken. Guy also includes delirium, anæsthesia, and paralysis, as occasional symptoms. In rare cases the symptoms assume *a remittent form*, the patient, after several hours' insensibility, recovering consciousness, but relapsing after an interval into coma, terminating fatally (see following case).

Case.—Case of the Hon. Mrs. Anson—"This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit for half an hour, and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of laudanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours the patient revived, her face became natural, the pulse steady, the power of swallowing returned, she was able to recognize her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes; the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."

Unusual modes of administration.—A case is reported of death from application of a poultice to the abdomen containing about one ounce of laudanum.[1] Serious symptoms have arisen from the application of opium to a wound. Death has occurred from the application of morphine to a wound; also from hypodermic injection of morphine, and from the injection of an enema of opium into the rectum. The introduction of opium into the vagina may cause death, and is a not uncommon method of attempting suicide in some parts of India.

Case.—**Opium poisoning, homicidal, in children.**—In 1889 the mother of a female child about two months old left her child in the verandah of her house in Sitimari, while she went to fetch water. On returning she found the child sucking the finger of a woman who had come during her absence. This woman, on being asked what she was doing, hastily wiped her right hand in a piece of rag and told the mother that she was giving the child some "bread," a piece of which she showed in her left hand. The woman then left, and the child soon commenced vomiting and died within a few hours. Opium was detected in the viscera of the child, and the rag on which the accused woman wiped her finger was also found to bear stains of opium. The bread which the accused held in the left hand contained no opium. The mother wiped the mouth of the child, when it vomited, with a piece of cloth, which was also forwarded for examination, and in the stains on which opium was detected. —L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case.—The civil surgeon of Patna forwarded the viscera of a Hindu male child, aged about six months, who was said to have met his death under the following circumstances, as reported by the police:—"The relatives of the deceased stated that the mother of the deceased was nursing another child; the mother of the latter child took the deceased on her lap and went out, when the deceased began to cry. The mother

[1] Tardieu, quoted by Blyth, p. 288.

of the deceased, suspecting something wrong, took her child from the woman and brought it home, but the child died within a few hours." Opium was detected in the viscera of the child. Both of these cases occurred in the districts where opium is cultivated in Upper Bengal.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case.—**Opium poisoning with cut throat.**—Suicidal.—In 1897 in Calcutta a Jew was found lying dead in his room with a deep suicidal cut on the throat. The stomach was forwarded for analysis and found to contain lumps of solid opium. Death resulted from hæmorrhage, by opening of the wind-pipe and large blood vessels on both sides of the neck, but the presence of the large quantity of opium in the stomach indicated that the man was a determined suicide. Deceased evidently took opium first: but finding life still prolonged, had recourse to the knife to hasten his end. Obviously, in cases of this description, there is no opium odour in the breath.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case.—**Poisoning by applying opium to a wound.**—A Burman boy was struck on the forehead, causing a gaping wound about an inch long. This the parents, about three hours after, stuffed with about forty-five grains of opium. On the third day he was brought to a medical man (Dr. H. W. Jones) in a semi-comatose state, but recovered under active treatment.—Chevers, *Med. Jur.*, p. 228.

Diagnosis.—1. From apoplexy. Here the chief points of distinction are: (*a*) The age and appearance of the patient. Apoplexy generally, but not invariably, attacks the old, and it is more common in fat than in thin persons. (*b*) The history of the case. In apoplexy, the symptoms, as a rule, come on abruptly; in opium poisoning they advance gradually. (*c*) The state of the pupils. In apoplexy, the pupils are dilated, except in apoplexy of the pons varolii, when they are contracted. In opium poisoning, the pupils are contracted except towards the end of the case, when they become dilated. (*d*) The odour of opium in the breath. This, however, may be absent in opium poisoning. (*e*) Convulsions, a bloated face, and impossibility of rousing the patient, are all more in favour of apoplexy than in favour of opium poisoning. 2. From uræmic coma.—Here chief reliance would be placed on (*a*) the history of the case; (*b*) the presence in, or absence from, the urine, of matters indicative of disease of the urinary organs; (*c*) the state of the pupils, contraction pointing to opium poisoning; and (*d*) the presence or absence of an odour of opium in the breath. 3. From other narcotic poisoning.—Alcoholic poisoning is sometimes difficult to distinguish from opium poisoning. In the first, the pupils are usually dilated, but may be contracted; and there is often an odour of alcohol, and not of opium, in the breath. In poisoning by carbolic acid, the pupils, as in opium poisoning, are contracted; here, however, the local action of the poison on the lining membrane of the mouth would most probably serve to distinguish the case. Contracted pupils, also, are present in poisoning by Calabar bean, may be present in aconite poisoning,

and also, except during the fits when the pupils are usually dilated, in poisoning by strychnia. The three poisons last mentioned, however, are not narcotic in action.

Fatal dose: This is affected by:—1. Age.—Children are extremely sensitive to the action of this drug. 2. Habit.—Persons in the habit of taking opium, or its preparations, acquire a resisting power to its action; *e.g.* a case is on record of an opium eater who was in the habit of swallowing nine ounces of laudanum (tincture of opium) daily; and another of a lady, aged twenty-six, who took ten grains of acetate of morphine three times a day for ten years. 3. Disease.—In some diseases, *e.g.* tetanus, and diseases accompanied by severe pain, large quantities of opium are tolerated. In other affections, *e.g.* Bright's disease, comparatively small doses may produce serious effects. 4. Idiosyncrasy.—Some persons are easily affected by small doses of opium; others are but little affected by large doses. 5. Quality of the drug.—As already pointed out, the percentage of morphine in opium varies greatly. Garrod, however, remarks that, although good opium contains one-tenth of its weight of morphine, morphine is not ten times, but only about four times, as strong as opium. Hence, although ordinary Indian opium probably, as a rule, contains only one-fourth to one-half as much morphine as B.P. medicinal opium, it does not necessarily follow that the latter is from two to four times as strong as the former.

Fatal dose for children.—Death has been caused in an infant, five days old, by two drops of tincture; in another, nine months old, by four drops of tincture; and in a third case, one grain of Dover's powder, equal to one-tenth of a grain of opium, nearly killed a child four months old (Taylor [1]). **For adults.**—In the case of these, the smallest fatal doses recorded are: two and a half grains of extract, equal to four grains of crude opium (Taylor [2]), and four and a half grains of opium taken along with nine grains of camphor (Christison [3]). Christison also mentions three cases in which elderly persons, suffering from respectively (1) severe catarrh, (2) cough, and (3) asthma, died from doses equal to less than four grains of opium. In one of these cases, the fatal dose was twenty-five drops of the tincture, and in another, fifteen drops of Battley's solution. The case just mentioned excepted, the smallest fatal dose of the tincture on record appears to be two drachms. Blyth, however, points out that the tincture, as usually sold in England, varies greatly in strength. Recovery has been recorded from very large doses

[1] *Poisons*, p. 557. [2] *Io.*, p. 556. [3] *Ib.*, p. 714.

of opium. Woodman and Tidy consider that four grains of opium (presumably English medicinal) would in most cases prove a poisonous dose.[1]

Fatal period.—Shortest recorded, forty-five minutes. Usual period nine to ten hours; in rare cases, two to three days. The prognosis is favourable if the patient survives twenty-four hours.

Treatment.—If the poison has been introduced into a wound, etc., remove it as far as possible and wash out the part. If it has been swallowed, wash out the stomach well by the stomach-pump; if the latter is not available, then give an emetic or inject apomorphine hypodermically. Endeavour to rouse patient and keep him roused by cold affusion, sinapisms, and flicking with a wet towel, and in severe cases the faradic current. In the less severe cases a cold douche and walking the patient about may be sufficient, but the forced perambulation should never be done where the surface of body is cold or where coma is present. For profound coma artificial respiration should be tried along with electricity. Administer hot strong infusion of coffee freely if the patient can swallow, also give a sniff of smelling salts. As a chemical antidote permanganate of potassium has been advocated by Moor[2] and his success confirmed by many others, Dr. Maynard having used it successfully in nineteen cases in India.[3]

Moor recommends 10 to 15 grains of potassium permanganate dissolved in 3 to 8 ounces of water to be repeated every half-hour for three or four times. If crude opium or the uncombined alkaloid has been taken, the solution of permanganate is to be acidulated with a little sulphuric acid. One grain of permanganate in one ounce of water he recommends should be given for each grain of morphine or every 10 grains of opium taken.[4] Luff found that on mixing 3 grains of acetate of morphine with vomit and then treating the mixture with 4 grains of permanganate dissolved in 4 ounces of water, no morphine could be extracted from it; and he recommends that the stomach should be washed out at intervals with a weak solution of permanganate to oxidize any of the poison which may be excreted into it. The permanganate should not be used in concentrated solution, as it may corrode.

Atropine introduced hypodermically has been used as a

[1] *For. Med.*, p. 371.
[2] *Medical Rec.*, 1894; also *Permanganate Treatment of Opium Poisoning*, London, 1899.
[3] *Brit. Med. Jour.*, May 16, 1896.
[4] *Ib.*

physiological antidote to stimulate the respiratory centres, but its utility is somewhat doubtful. One-twentieth of a grain is injected and may be repeated till pupils dilate. The following cases show that in opium-poisoning very large doses of atropine are tolerated. This, to a certain extent, supports the theory that atropine is a physiological antidote for opium.

In 4½ years ending November, 1885, 64 adults poisoned by opium were treated in the Jamsetjee Jeejeebhoy Hospital, Bombay, by hypodermic injection of atropine in ¼-grain doses, repeated at intervals, until dilatation of the pupils occurred. Of the 64, 31 died and 33 recovered. Of the 31 who died, 7 had been under 2; 11 over 2 and under 6; 8 over 6 and under 20; and 5 over 20 hours in hospital. The amount of atropine injected in the fatal cases was, in 9 a ¼ of a grain; in 10 over ¼, but not more than ¾ of a grain; in 8 over ¾ and under 1½ grains; and in 4 over 1½ grains. The amount injected in the 33 cases of recovery was, in 12 ¼ of a grain; in 12 more over ¼ to ¾ of a grain; and in 9 from over ¾ to 1½ grains.

Strychnine as well as ether hypodermically are useful.

Post mortem appearances.—Not characteristic. McLeod summarizes them as follows in well-marked cases:—"Brain turgid; lungs congested; the head distended with liquid blood; liver and spleen engorged; mucous membrane of the stomach either natural or slightly and uniformly injected." [1]

Opium eating, etc.—The habit of opium eating widely prevails in India. Very generally the crude drug is used. Sometimes, however, as in Rajputana, a watery decoction, known as '*kusoomba*,' or '*Umal*' is employed.[2] Opium smoking is also much practised, a watery extract of the drug called '*chandul*' being commonly used for this purpose. The question whether opium eating, smoking, etc., is or is not injurious to health has been hotly debated. There appears, however, to be a pretty general consensus of opinion among medical men who have actually practised their profession in countries where these habits

[1] *Beng. Med. Rept.*, 1869, p. 109.

[2] Col. Todd frequently alludes to it in his *Rajasthan*. The act of eating opium together was the form by which the rival clans became reconciled, and personal friendships were declared. "*Umal lar Khana*"—to eat opium together—is the most inviolable pledge, and an agreement ratified by this ceremony is stronger adjuration. If a Rajput pays a visit, the first question is "*Umal Khya?*"—"Have you had your opiate?" "*Umal Khao*"—"take your opiate." On a birthday, when all the chiefs convene to congratulate their brother on another "knot to his years," the large cup is brought forth, and a lump of opium is put therein upon which water is poured, and by the aid of a stick, a solution is made, to which each helps his neighbour, not with a glass, but with the hollow of his hand held to mouth. A Rajput is fit for nothing without his *Umal*, and Col. Todd often dismissed his men of business to refresh their intellects by a dose, for, when its effects are dissipating, they become mere logs. "Opium," he adds, "is more necessary to the Rajput than his food."

prevail that, used in moderation, opium neither tends to injure health nor to shorten life. Abuse of opium, like abuse of alcohol, may cause derangement of digestion, and general impairment of health. Abuse of opium, however, is much less likely than abuse of alcohol to injure health, and appears to be much less common among opium eaters, smokers, etc., than abuse of alcohol is among alcohol drinkers. In persons accustomed to the use of opium, the preliminary stage of excitement, slight or absent in cases of poisoning, is a marked effect of a moderate dose. Chevers gives a case where a man, presumably an opium eater, previous to committing murder, swallowed, apparently to nerve himself for the deed, so large a quantity of opium that he died a few hours after committing the crime; see following case. For the question of criminal responsibility in such cases, see p. 389, also ' Alcohol.'

On animals.—It has been found that large quantities of opium may be given by the mouth to pigeons and other birds, without narcotism being caused. Blyth remarks that the explanation of this is that the poison is not absorbed, as subcutaneous injection of morphine has been found to act rapidly on all birds hitherto experimented on. In frogs, opium excites tetanus, followed by paralysis of reflex action.

Preparations of opium.—Of the stronger B.P. and I.P. preparations, the following quantities correspond to about one grain of opium:—*Extractum opii*, ½ to 1 grain; *pilula saponis comp.*, 6 grains; *pil. plumbi cum opio*, 8 grains; *pulvis ipecacuanhæ comp.* (Dover's powder), *pulvis opii comp.* and *emplastrum opii*, 10 grains; *unguentum gallæ cum opio*, about 13½ grains; *tinctura opii* (laudanum), 14½ minims. *Extract opii liquid*, and *vinum opii*, are both slightly stronger than the tincture.[1] Several patent medicines and quack nostrums also contain opium; among these may be mentioned *black drop*, an acetic acid solution of opium about four times as strong as the tincture. *Battley's liquor opii sedativus* has about the same strength as extractum opii liquidum, B.P., and *Nepenthe*, a nearly colourless alcoholic solution of opium, has about the same strength as laudanum. *Godfrey's cordial*, used as a

[1] Five to six drops of the tincture equal about ten minims. The liquid extract and the wine of opium are prepared from *extractum opii* (one ounce to the pint), while the tincture is prepared from dry opium, an ounce and a half to the pint. One grain of opium is contained also in the following quantities of other B.P. and I.P. preparations:—Fifteen grains *suppositoria plumbi composita*; twenty grains *pulvis kino co.*; twenty-nine minims *linimentum opii*; forty grains *pulvis cretæ aromaticus cum opio*; ninety-six minims *tinct. opii ammoniata*; half a fluid ounce *tinct. camporæ co.*; and about one ounce *enema opii*. Ten opium lozenges contain one grain of extract of opium.

sedative for children, contains one grain and a half of opium per fluid ounce. Other opiate preparations, used for the same purpose, are *Mrs. Winslow's Soothing-syrup* and *Dalby's Carminative.* The first contains about one grain of morphine, with other opium alkaloids, per ounce; and the second, about one-sixth of a grain of opium per ounce.

Morphine or morphia.—The symptoms, etc., in poisoning by this alkaloid, or one of its salts, are similar to those of poisoning by opium, except that convulsions are apparently oftener present. The alkaloid itself is only very sparingly soluble in water, and is not officinal. The two salts of morphine most commonly employed, both of which are officinal, B.P. and I.P., are the acetate and the hydrochlorate. Both these are much more soluble in water than morphine; the hydrochlorate being soluble in about sixteen parts of cold water, and less of boiling water, and the acetate more soluble than the hydrochlorate. The medicinal dose of either salt is one-eighth to half a grain. One grain of either may be regarded as a minimum fatal dose for an adult. The I.P. contains the following preparations of these salts:—Of the acetate, a solution, strength four grains to the fluid ounce; of the hydrochlorate, a solution of the same strength; also suppositories, half a grain in each, and lozenges, one thirty-sixth of a grain in each. The morphine habit is not uncommon in the larger cities, and in Burma a widely popular brand of pills for "the cure of opium eating" was found to contain morphine. The Burma Chemical Examiner in 1898 reported that in 51 cases analyzed morphine was detected in the substances examined, and the use of these pills had now extended throughout Lower Burma and as far as Mandalay. Those consumed in the Arakan division were usually made locally, while those used elsewhere in Burma were apparently of Chinese manufacture.

Chlorodyne contains morphine as its chief active ingredient, and some cough lozenges have proved poisonous on account of the chlorodyne used in their manufacture. According to Blyth,[1] *Brown's* chlorodyne contains in each fluid ounce of the mixture about seven grains of hydrochlorate of morphine, six drachms of chloroform, and 10½ drops of Scheele's prussic acid, and 53 minims of tincture of Indian hemp. In poisoning by chlorodyne the pupil has been observed to be *dilated*,[2] doubtless due, as

[1] *Poisons*, p. 288.

[2] Hughes' *Braithwaite's Retrosp.*, 1899, p. 5, and A. Powell, *Ind. Med. Gaz.*, 1902, p. 306. The latter observer found the pupil to be *widely dilated* in all of the last four fatal cases. This experience is opposed to Taylor's *dictum* that "usually in fatal and dangerous cases there is contraction."

suggested by Professor Powell, to the symptoms of prussic acid poisoning preceding and overshadowing those due to morphine. *Treatment.*—Should keep in view of these constituents of this mixture. In a case reported by Dr. Hughes the pupils were fixedly dilated slightly, and lips cyanosed. Ether and strychnia were given, but respirations ceased. Artificial respiration was kept up for three hours, procuring shallow breathing till death some hours after by cardiac failure.[1]

Poppy capsules, *Post* (Hind.), (see Fig. 51), are narcotic. Syrupus papaveris, B.P. and I.P., prepared from the capsules freed from the seeds, is said to have a strength equal to about two grains of opium per fluid ounce. The B.P. and I.P. also contain an extract prepared from the same, the medicinal dose of which is two to five grains. Poppy oil, expressed from the seeds, *Kash-kash-ka tel* (Hind.), is used largely in India in food, and appears to be inert. Another oil met with in India under the name of poppy oil, unlike poppy-seed oil, is dark brown in colour, and has a strong odour of opium. It appears to be a vegetable oil which has been used for softening old opium; it is employed as an anodyne application, but I have not been able to detect either morphine or meconic acid in the specimens I have examined.

Detection.—Meconic acid in solution gives, with ferric chloride solution, a blood-red colour, not destroyed by dilute hydrochloric acid (distinction from acetates), and not destroyed by mercuric chloride solution (distinction from sulphocyanic acid). Morphine in solution gives: (1) with strong nitric acid, an orange colour changing to yellow; (2) with a mixture of bichromate of potassium solution and strong sulphuric acid, a green colour; and (3) with a mixture of starch solution and solution of iodic acid, a blue colour. In solid form morphine sublimes at 330° F. without change of colour, it melts at 340° and darkens with deposit of carbon; whereas strychnine sublimes at 345°, melts at 430°, when it darkens from deposited carbon; tartar emetic sublimes slowly at 480°, and chars at 550°; whilst arsenious anhydride, calomel, and corrosive sublimate sublime without change of form or colour at 260°, 240°, 200° respectively.

From organic mixtures, meconic acid and morphine may be separated as follows:—Digest solid matters cut up into small pieces (or fluid matters concentrated on a water bath to a syrup) with alcohol acidulated with acetic acid, strain through cloth,

[1] Morphine is only very sparingly soluble in ether and chloroform.

evaporate the alcoholic tincture nearly to dryness on a water bath, add a little water and a few drops of acetic acid, and filter. To the filtrate add excess of sub-acetate of lead solution and boil, filter again; the filtrate will now contain the morphine as acetate, and the precipitate the meconic acid as meconate of lead. These are to be separately treated as follows:—(1) The precipitate is to be suspended in water, sulphuretted hydrogen passed through the liquid, the liquid filtered, evaporated to a small bulk, and tested for meconic acid; (2) The morphine filtrate; sulphuretted hydrogen is passed through this until all the lead is thrown down; the liquid is then filtered and concentrated, and morphine extracted from it as in the Stas-Otto process (see p. 545), using amylic alcohol as a solvent. As an aid to diagnosis in a case of poisoning, the ferric chloride test for meconic acid may be applied directly to a small portion of the liquid removed by the stomach-pump. Microscopically on evaporating spontaneously the morphine extract with a drop of dilute sulphuric acid on a glass slide, crystals of morphine sulphate will be obtained as in Fig. 53.

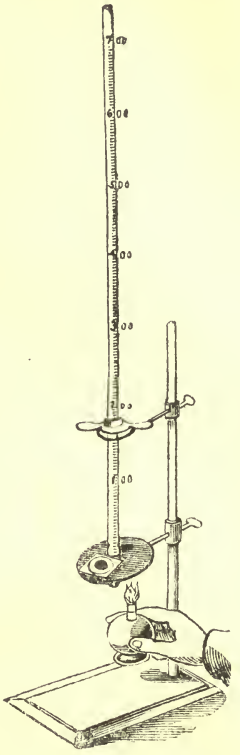


Fig. 52, Sublimation.—Apparatus for testing poisons (inorganic and organic) and noting the temperature at which change of form and colour and sublimation occur, showing the spirit-lamp applied to the substance placed on the disc of copper, with hollow nipple in which is received the thermometer.

Autenreith recommends the following method of carrying out the meconic test. To the watery liquid left after extraction of alkaloids by the Stas-Otto process add some calcined magnesia and boil for about three minutes. Filter, and acidulate the filtrate with dilute hydrochloric acid. On then adding a drop of ferric chloride solution a reddish-brown colour develops. If, as frequently happens, the liquid is already of a dark-brown colour, it must be diluted with water until fairly transparent before addition of the ferric chloride. Extracts of certain grains used as food in India when treated by the above method give a brown colour which sometimes is not dissimilar from that given by extracts containing opium. Indian opium (but not Turkey opium) contains a substance that gives a rose-red colour when boiled with hydrochloric acid. In carrying out the Stas-Otto

test this substance does not pass to any great degree into the acid ether extract as does a similar pink colour producing substance formed in the growth of cholera, *B. Coli*, and other microbes. It passes into the alkaline ether extract. A few c.c. of half per cent. acetic acid are added to this ether extract. The ether is evaporated off. The residual liquid gives a pink colour when heated with a few drops of dilute hydrochloric acid. On filtering the coloured liquid the colour remains attached to the filter paper, a fact that is sometimes of use when brown colouring matters are present. This test is known as the porphyroxin test. Occasionally different kinds of grain and flour give a pink colour when boiled with hydrochloric acid. Further research is required to decide whether, as is

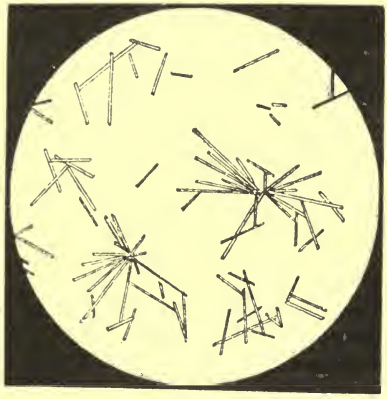


FIG. 53.—Morphine Sulphate × 100.
Obtained by evaporation spontaneously with dilute sulphuric acid.

probable, the pink colour-producing substance in these cases is one that passes into the acid ethereal extract.

Failure to detect, etc.—The detection of opium depends on the recognition of morphine and meconic acid, two substances which form only a fractional part of the crude drug. A very minute dose of opium, however, containing only an infinitesimal quantity of these substances, will prove fatal to a young child. In such cases analysis often fails to detect the presence of the poison. Cases also have often occurred, in which adults have died from the effects of a considerable dose of opium, and yet it has been found impossible to detect the poison after death in the viscera. Among other cases of this kind, Taylor mentions one of a young woman who died in nine hours from a dose of

one and a half ounces of laudanum, and yet, in the contents of whose stomach after death, no trace either of meconic acid or morphine could be detected. On the other hand, opium has several times been detected in the contents of the stomach of persons poisoned by it, four months or more after death. The explanation of these differences is probably something as follows. When an individual has lived for some time after swallowing the poison, especially in solution, such portion as has not been got rid of by vomiting becomes absorbed and distributed through the body, its constituents after absorption either undergoing change or becoming so very widely distributed that unless a very large portion of the body is submitted to analysis, a sufficient quantity of them for identification cannot be isolated. On the other hand, if the poison has been taken in the solid form, or death has been rapid, a portion of it, failing to undergo absorption before death, remains in the stomach, and, as opium has a considerable resisting power to putrefaction, its presence may still be detected even if this is far advanced. Finally, it may be pointed out, that the presence of realgar, as an adulterant in opium (see p. 505), might lead to complications of evidence in a case of opium-poisoning.

Alcohol.

Alcoholic poisoning is not very common in India except in the larger cities, as alcoholic liquors are forbidden to Mohammedans and seldom indulged in by Hindus of the better classes.

Alcohol.—Water-free or 'absolute' alcohol is seldom met with. Rectified spirit, the nearest approach to it in common use, contains 16 per cent. by weight of water. The quantity of real alcohol in liquors sold for potable use is approximately: in strong spirits, such as brandy, whisky, rum, arrack, gin, etc., 37 to 45 per cent.; in strong wines, such as port and sherry, 15 to 22 per cent.; in light wines, *e.g.* claret or hock, 6 to 9 per cent.; and, in malt liquors, such as porter and ale, 3 to 6½ per cent. *Proof spirit* (in terms of percentage of which the strength of alcoholic liquors is often stated) contains 49·24 per cent. by weight of absolute alcohol.

Acute alcoholic poisoning may arise from the inhalation of alcoholic vapours, as well as from swallowing alcoholic liquids. There is usually a previous stage of excitement and delirium. This is followed by stupor deepening into coma with stertorous breathing. The face is usually flushed, the breath smells of alcohol, and the pupils are generally but not always dilated. As a rule the patient can be temporarily roused into partial

sensibility by a loud noise or violent shock. Vomiting and convulsions are occasional symptoms. Occasionally also the symptoms remit, the patient recovers consciousness, but subsequently dies from failure of the respiration.

Diagnosis of alcoholic poisoning from concussion of the brain, apoplexy, and poisoning by other narcotics, *e.g.* opium, is sometimes a difficult matter. In these the face is usually pale, and in opium poisoning the pupils are contracted. A smell of alcohol in the breath, it must be recollected, merely indicates the presence of alcohol in the stomach; accompanying narcotic symptoms may, or may not, be due to alcohol poisoning.

Fatal dose, etc.—In terms of absolute alcohol, the probable minimum fatal dose is:—For a child under twelve, 1 to 2 ounces; for an adult, 2½ to 5 ounces. Recovery has been recorded in an adult after swallowing a quart of whisky (probably equal to at least 9 ounces of absolute alcohol), and in a child of five after swallowing 3 ounces of rum (probably equal to 1 to 1½ ounces absolute alcohol). In alcohol poisoning, death obviously may occur as an indirect result, as, for example, from a fall or other accident brought about by intoxication. After coma has supervened, death may occur in a few minutes or not for days. Blyth states that death has occurred after coma of three, four, or even six days' duration.

Treatment.—The contents of the stomach should be at once evacuated, preferably by the stomach-pump; and endeavours should be made to restore sensibility by cold affusion, galvanism, ammonia to the nostrils, etc. Strong coffee may be administered as in opium poisoning. Acute alcoholism in robust and otherwise healthy subjects may be treated by large doses of digitalis, but the perils of this treatment are obvious and its value doubtful.

Post mortem appearances.—The mucous membrane of the stomach generally, but not always, shows signs of inflammation. These vary from patches of redness to a condition similar to that found in poisoning by a powerful non-corrosive irritant. The brain is usually congested, so also frequently are the lungs; and the large vessels of the chest are usually found full of dark fluid blood. An odour of alcohol is usually present in the contents of the stomach, and may be noticeable also in other parts of the body.

Chronic Alcoholic poisoning.—Long continued abuse of alcoholic liquors may, as is well known, give rise to disease of various organs, and to delirium tremens. Delirium tremens

may be distinguished from intoxication by the history of the case and the character of the delirium. This may be shortly described as a delirium of dread, accompanied by delusions most commonly connected with visual perception. The patient imagines he sees various objects lying around him, or crawling about, and is often violent, with a tendency to suicide, or less commonly to homicide. As a rule he can be roused into temporary sanity when sharply spoken to. Legally, delirium tremens is unsoundness of mind,[1] not intoxication.

The criminal responsibility of individuals for acts done while in a state of alcoholic or other intoxication[2] is dealt with in *ss.* 85 and 86 of the *Indian Penal Code. Section* 86 is as follows:—"In cases where an act done is not an offence unless done with a particular knowledge or intent, a person who does the act in a state of intoxication shall be liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated, unless the thing which intoxicated him was administered to him without his knowledge or against his will."

Mayne, in commenting on this section, writes: "Sometimes in determining the quality of an offence, evidence is necessary of a specific existing state of mind, which must be found as a fact, and cannot be assumed. For instance, supposing a fatal blow to be struck under circumstances of grievous provocation; it might be shown that, notwithstanding the provocation, the defendant had acted, not under its influence, but from a preconceived malicious resolve to kill. If so, the offence would be murder. But the mere fact of the deadly blow would not be sufficient evidence for that purpose. Given the provocation, the legal inference derivable from the character of the blow would be exhausted in making the act be culpable homicide not amounting to murder. Evidence of a different state of mind would be required to constitute the graver charge. In this state of things, intoxication might be an answer to the charge of murder."

Methyl Alcohol, Wood-Alcohol, Wood-Spirit, Wood-Naphtha, or Pyroxylic spirit, obtained by the destructive distillation of wood, has an action on the system similar to that of ethyl alcohol. It has a peculiarly disagreeable odour, and is used for fouling rectified spirit, so as to render it

[1] For the criminal responsibility of persons of unsound mind, see 'Insanity,' p. 393.

[2] The responsibility is the same, no matter what the *nature* of the intoxicating agent is.

non-drinkable. Thus rectified spirit, mixed with ten per cent. of pyroxylic spirit, is sold under the name of 'methylated' spirit for use in arts and manufactures. Yet, despite its nauseous odour and taste, this methylated spirit is not unfrequently consumed by drunkards; and its wholesale use as a substitute for whisky on the passing of the laws in the United States of America prohibiting the sale of intoxicating liquors caused in a few weeks in December, 1919, over a hundred deaths in New York and other United States towns, with several thousands of cases of blindness, paralysis and convulsions.

Symptoms.—Blindness followed the drinking of $\frac{1}{4}$ ounce sometimes, and death after $1\frac{3}{4}$ to $3\frac{1}{2}$ ounces. The poisonous effects are most marked on the eyes, causing either temporary blindness, or in severe cases atrophy of the optic nerves, resulting in permanent blindness. It also causes heart failure.

Amyl Alcohol is a constituent of *Fusel oil*, or potato spirit. —This is a higher alcohol of the same homologous series as the two alcohols mentioned above, but, unlike them, is not miscible with water. It is much less volatile than ethyl alcohol, and is found in the last portions of the distillates obtained from fermented potatoes and fermented grain. Like ethyl alcohol, it is a narcotic poison, but is much more powerful in its action, and more prone to cause convulsions. It appears to be more powerfully poisonous when inhaled in the form of vapour than when swallowed in the liquid form. Carelessly distilled whisky and other spirits are apt to contain amyl alcohol, and, in consequence, to be more powerfully intoxicant and more injurious to health. When such spirits are kept, the amyl alcohol they contain gradually decomposes, fragrant ethers being formed, and the spirit, as a consequence, improves in flavour, and becomes less hurtful.

Detection.—(*a*) All three alcohols are inflammable, and burn with a pale blue flame.

(*b*) *Formation of Iodoform:* This is best done by the process described in Remsen's "Organic Chemistry."

(*c*) *Sulpho-Molybdic Acid Test.*—Distil viscera suspected to contain alcohol. Pour a small quantity of the first portion to distil over on to the surface of some Sulpho-Molybdic acid contained in a test tube. A blue ring forms at the junction of the two liquids. Sulpho-Molybdic acid is made by dissolving molybdic acid in concentrated sulphuric acid with the aid of heat. *The failure to give this test a proof of the absence of alcohol.*

The converse is not the case, as a few other substances besides alcohol give the reaction.

(*d*) All three, if added to a mixture of bichromate of potash solution and strong sulphuric acid, change the colour of the mixture from red to green.

(*e*) Methyl and ethyl alcohols are both miscible with water. Methyl alcohol has a peculiarly disagreeable odour. Ethyl alcohol has a pleasant odour, and, when heated with sulphuric acid and an acetate, gives vapours of acetic ether, the odour of which is peculiar and characteristic. Amyl alcohol is not miscible with water; treated as above, it evolves amyl acetate, which has the characteristic odour of jargonelle pears.

From organic mixtures, methyl and ethyl alcohols may be readily separated by distillation. The liquid to be distilled, if acid, should first be neutralized. Methyl alcohol, on account of its superior volatility, should be looked for in the first portions of the distillate. From the distillates the alcohols may be obtained, sufficiently free from water for recognition, by shaking with solid potassic carbonate. The liquid will then separate into two layers, of which the upper one contains the alcohols. Amyl alcohol, the boiling-point of which is 132° C., will be found either in the last portions of the distillate, or in the residue in the retort. From the latter it may be removed by shaking with ether, in which it is soluble.

Ether, Sulphuric Ether, or Ethyl oxide.—This, when swallowed, produces effects similar to those produced by alcohol. It appears to be more rapid and more powerful in its action than alcohol, but its effects pass off more quickly. Blyth estimates that one fluid ounce swallowed would kill most adults. It is sometimes taken by spirit-drinkers, as a substitute for whisky, brandy, etc. Ether vapour, if inhaled, produces effects similar to those produced by inhalation of chloroform vapour, but is said to be less likely to cause arrest of the heart's action. Inhalation of ether vapour has, however, caused death. A given quantity of ether acts more powerfully when inhaled in the form of vapour than when swallowed in the liquid form.

Amyl Nitrate.—Inhalation of the vapour of this is employed for the purpose of relaxing vascular spasm. When inhaled, its first effect is to cause flushing of the face, throbbing of the carotids, a quick full pulse, and giddiness. Experiments on animals show that large doses of the vapour cause convulsions, coma, and death.

Chloroform.

Chloroform, when swallowed, produces effects very similar to those produced by alcohol, causing, if taken in sufficient quantity, coma with stertorous breathing and dilated pupils. As in alcohol poisoning, vomiting and convulsions are occasionally present. Taylor mentions a case in which an adult, who had swallowed three ounces, recovered sensibility in fourteen hours, but died of acute gastritis with collapse, twenty-nine hours after swallowing the poison. The smallest dose of liquid chloroform which has proved fatal to an adult is 3·8 drachms: a case of recovery, however, is reported after swallowing four ounces. One drachm proved fatal in three hours to a boy *æt.* four. A given quantity of chloroform acts very much more powerfully when inhaled in the form of vapour than when swallowed in the liquid condition. Inhalation of chloroform vapour causes (1) a stage of excitement, with flushing of the face and contracted pupils: in this stage delirium is nearly always present, and sometimes the patient struggles violently. To this succeeds (2) a stage of complete anæsthesia, with relaxation of the muscles and suspension of reflex action. This is the stage in which surgical operations are performed; it may be looked on as fully developed when touching the conjunctiva fails to cause reflex closure of the eyelids. If the inhalation of chloroform is continued, (3) a stage of paralysis sets in. Respiration becomes slower and more feeble, the heart's action becomes weaker, and death ensues from paralysis of respiration, or from arrest of the heart's action. Death, however, may occur during any stage of the inhalation, and may be due (*a*) to sudden stoppage of the action of the heart, liable, in exceptional cases, to occur at any stage; or (*b*), to asphyxia, which may be brought about in various ways, *e.g.* by closure of the glottis, owing to pressure of the tongue, or by blood or vomited matter finding its way into the air-passages. In more than one case death has occurred within two minutes of the commencement of the inhalation. In one case thirty drops, and in another fifteen to twenty drops, inhaled in vapour, caused death. A much larger quantity than this (about $3\frac{1}{2}$ drachms) is commonly required to cause anæsthesia. The more concentrated the vapour, the more likely is danger to arise. The death ratio from chloroform during operations is variously estimated at 0·75 to 3·4 per 10,000 cases.

Cases occasionally occur in which an individual alleges that he or she has been rendered insensible by chloroform, and while in that condition, robbed or raped. As bearing on the

question of the truth or falsity of such charges, it may be noted: (1) That chloroform vapour does not cause immediate insensibility, and that it is difficult to administer chloroform to persons against their will, unless considerable force is employed. (2) That to successfully administer chloroform vapour during sleep requires the greatest skill and care, and even then can only be accomplished in a small proportion of cases; and (3) That inhalation of chloroform may cause sexual excitement, accompanied by delusions, remembered after recovery of sensibility, and believed to be real events.[1]

Treatment.—If *liquid* chloroform has been swallowed, the stomach-pump should be used at once. In poisoning by the *vapour* it should first be pointed out that chloroform vapour should always be given greatly diluted with air, and on a nearly empty stomach; and that its administration should be avoided in patients suffering from certain cardiac diseases. In cases of poisoning, the patient should be placed in a horizontal position, and cold affusion, artificial respiration, and galvanism employed. It should be seen that nothing mechanically impedes respiration, and that the tongue is well forward. It may be necessary to draw it forward with a pair of forceps. Turning the head on one side will often suffice, and will, at the same time, allow of the escape of vomited matters, etc.

Post mortem signs.—Not characteristic. The blood is usually dark-coloured and very fluid. After death from swallowing liquid chloroform, signs of inflammation of portions of the gastric mucous membrane have been found.

Detection.—Death from chloroform may occur, and analysis fail to detect the presence of poison in the viscera, owing to its having escaped by volatilization, or its having become decomposed in the body. This last may be due to the action of alkalies, a formate of the alkali being formed according to the following equation: $CHCl_3 + 4KHO = KCHO_2 + 3KCl + 2H_2O$. From organic mixtures chloroform may be separated by distillation, and recognized in the distillate by its peculiar odour. Or the mixture, first neutralized if acid, may be distilled, and the vapours passed through a glass tube heated to redness. Under these circumstances, the chloroform is decomposed with formation of hydrochloric acid and free chlorine. The presence of the first is shown by the vapours reddening moistened blue litmus paper, and producing a white precipitate in silver nitrate solution; and of the second, by the

[1] Lauder Brunton's *Pharmacology*, p. 723.

vapours causing a blue colour to appear on paper soaked in a mixture of starch and potassium iodide solutions.

Case.—**Chloroform poisoning—suicidal** by inhalation.—A Eurasian woman was found dead in her bed with a handkerchief on her mouth and nose covered over by a pillow, and a bottle containing chloroform lying near the handkerchief with chloroform dribbling from it. The door of the room was bolted from inside. The husband and the wife were not on good terms, and she made a similar attempt on her life with chloroform about six months prior to this incident. There were marks of blisters on her lips and cheek and inside the nostrils, which were the local effects of the chloroform. The mouth, the gullet, and stomach showed no signs of irritation. The blood was of a somewhat cherry-red colour, and on analysis was found to contain chloroform. The viscera on distillation also yielded traces of chloroform.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Chloral.

This is used in medicine as a hypnotic in the form of chloral hydrate, and has in several cases caused death. It causes deep sleep, followed, if an overdose has been taken, by coma with motor paralysis; and slowing, weakening, and ultimate arrest of the heart's action, and of the movements of respiration. These effects appear to be due to the action of the drug on the nerve-centres, and not on the nerves. The pupils are nearly always contracted. A skin eruption, in some cases resembling that of scarlatina, in others urticaria or purpura, has been observed. Possibly, in many cases the fatal result is attributable to the decomposition of chloral within the body into chloroform.[1] This may be effected by the action of alkalies, a formate of the alkali being at the same time formed thus: $C_2HCl_3O + KHO = KCHO_2 + CHCl_3$. Sometimes a single overdose of chloral causes sudden death by syncope.

Fatal dose.—The probable minimum fatal dose cannot be stated with certainty. In one case thirty grains, or not more than a full medicinal dose, caused the death in thirty-five hours of a woman *æt.* twenty. Persons, however, have recovered from doses of 150 and 160 grains. The syrup of chloral B.P. contains ten grains in each fluid drachm.

Post mortem signs.—Considerable congestion of the vessels of the brain and its membranes has been observed.

Treatment.—Evacuate the contents of the stomach, preferably by the stomach-pump; administer decoction of coffee freely,

[1] From the experiments of Hammärsten, it would appear that chloral ordinarily acts without undergoing decomposition into chloroform (see Lauder Brunton's *Pharmacology*, p. 715).

introducing it by the stomach-pump if necessary; keep the patient warm, and endeavour to restore respiration. Hypodermic injection of strychnia is strongly recommended by several authorities; its efficacy is denied by others. If used, two or three drops of the solution of strychnine, B.P. or I.P., may be injected and very cautiously repeated at intervals of fifteen or twenty minutes.

Chronic poisoning by chloral.—The long-continued use of chloral in medicinal doses may give rise to skin eruptions of the character noted above, impairment of the cerebral functions, and partial paralysis of the limbs. In some cases, insanity has been attributed to chloral drinking.

Detection.—Organic mixtures containing chloral should be rendered alkaline by caustic potash, distilled, and the vapours tested for chloroform.

Bromal hydrate, the corresponding bromine compound, has a similar action to chloral hydrate, but is a more powerful poison.

Cocaine.

Cocaine, the active principle of the Coco, or "Divine Plant," of the Incas of South America, *Erythroxylon coco*, the leaves of which are still chewed by natives of South America as a restorative against the strain of fatigue. This alkaloid is largely used as a local anæsthetic by dentists and others; but is of medico-legal interest from its abuse as a cerebral excitant and narcotic.

In India, since about the year 1900, the eating of cocaine hydrochloride has become a habit with many persons, especially in the larger cities, where it is extensively used as a pleasing intoxicant or stimulant and aphrodisiac by natives of India, and to counteract the soporific and prostrating effect of over-indulgence in opium. It is sold now in most bazaars by the *pan* 'betel' sellers.

Action.—Locally it paralyzes the terminals of the sensory nerves, blanches mucous membranes, and is quickly absorbed, dilating the pupils. **Internally** it first stimulates and then paralyzes the nerve centres of the brain and cord, dilating the blood vessels. The stimulation is of an exhilarating kind. Cocaine "fascinates by the promptness with which it relieves all sense of exhaustion, dispels gloom and exhilarates, producing a sense of happiness and well-being, which transports

at once to a longed-for elysium; but this exhilaration is followed by a state of mental depression. Through continual indulgence an intense craving for the drug or its effects is produced" (Dr. A. H. Brundage). The results of the cocaine habit are even more demoralizing and harmful than those produced by over-indulgence either in alcohol or morphine. In poisonous doses it ultimately slows the heart, reduces the blood pressure, and paralyzes respiration, inducing coma and raising the temperature; and convulsions may occur from the asphyxial coma. In *chronic* poisoning patient feels as if grains of sand or worms were under the skin—this is 'Magnan's' symptom. The *post mortem* symptoms are those of asphyxia and coma, with blood-clots in and near the heart.

Fatal dose.—About two-thirds of a grain of cocaine hydrochloride injected subcutaneously caused death of a woman aged 71 in five hours; and ten grains of the hydrochlorate swallowed by a woman caused death in 40 or 50 minutes.[1] Habituation establishes toleration for much larger doses. Some deaths have occurred through its use in order to procure local anæsthesia in dentistry.

Treatment.—If poison was swallowed, use stomach-pump. If injected hypodermically, administer stimulants, with inhalation of chloroform, or if the spasms hamper respiration, artificial respiration may be necessary.

Tests for cocaine and allied substances.—The following method is recommended by Dr. E. H. Hankin :—

Cocaine, tropococaine, alypin, and scopolamine form precipitates with solutions of permanganate of potassium, which may assume a crystalline form. By the adoption of the following procedure the use of permanganate results in a very delicate test for these substances.

(1) Spread a drop of a strong permanganate solution on a glass slide and allow it to dry. Thus a film of minute permanganate crystals is formed on the slide.

(2) On the glass slide, near the permanganate film, place a drop of a saturated or half-saturated alum solution.

(3) Put into the drop of alum solution a very small trace of cocaine. It dissolves at once.

(4) With a coverslip draw the drop of alum solution up to the edge of the permanganate film. Then allow the coverslip to fall, so that the alum runs over the permanganate.

(5) Do not disturb the coverslip. Within a minute or two the characteristic crystals of permanganate of cocaine begin to form. Under the microscope the precipitate is seen to consist at first of oily drops of red colour. These gradually dissolve *pari passu* with the formation

[1] Dixon Mann, p. 607.

of the crystals. These crystals if isolated are nearly square in shape. Crystals of this form develop instantly if the coverslip is moved. If the coverslip is not disturbed the crystals usually assume the form of branched irregular masses which show a remarkable play of colours when examined under polarized light. These cocaine permanganate crystals have a pale pink colour, and are quite unlike the dark-coloured permanganate crystals that may form near the edge of the coverslip.

Crystals of cocaine permanganate are soluble in a strong solution of cocaine in alum solution. Hence if too much cocaine has been used the crystals may fail to develop. In such a case the crystals may often be caused to appear by addition of another drop of alum solution.

If a number of specimens of cocaine are being examined, time is saved if coverslips are not employed. The drop of alum containing the supposed cocaine is simply smudged over the permanganate film, and the crystals will be found to form nearly as readily as under a coverslip.

Cocaine is occasionally sent for examination mixed with 30 to 50 per cent. of antipyrine. The antipyrine interferes with the permanganate test. It is necessary to remove it. To do so, dissolve the powder in water. Add ammonia. This precipitates the cocaine and leaves the antipyrine in solution. Filter. The residue of cocaine on the filter paper, when dissolved in alum, readily responds to the permanganate test.

Alypin gives somewhat similar crystals when tested with a permanganate film. But they differ from those yielded by cocaine in that, firstly, they form less readily with alum solution as a solvent, better if the alypin is dissolved in a strong solution of potassium bromide, and best of all if the alypin is dissolved in water. Secondly, alypin permanganate crystals are more elongated and more jagged in outline than those formed by cocaine.

Crystals formed by tropacocaine and permanganate are not pink as a rule, but red in colour. They are best formed when the tropacocaine is dissolved in water. They may take the form of curved feathery masses.

Scopolamine forms crystals with permanganate with some difficulty. They may appear when a strong solution of scopolamine in water is placed on a permanganate film. They often take the form of prisms pointed at one end and blunt at the other.

Permanganate crystals can usually only be obtained from lactate of cocaine after the latter has been decomposed so as to remove the organic acid. Ammonia is added to a solution of lactate of cocaine. The solution is then shaken up with chloroform. The chloroform is separated, washed, and shaken up with a small quantity of a solution of alum. The alum takes up the free cocaine, which can then be subjected to the test.

If pieces of paper in which cocaine is supposed to have been wrapped up are received for examination, a small piece of the paper is cut off, soaked for two or three minutes in a drop of alum solution. The latter will then give the permanganate test. Or the paper may be extracted with chloroform, which will dissolve the cocaine.[1]

Lett, in the *Quarterly Journal of Inebriety* for April, 1899, describes a method which he has devised which will detect this alkaloid in the urine of those who use the drug.

[1] See Hankin, "Tests for Cocaine and certain other Anæsthetics," *The Analyst*, vol. xxxvi., January, 1911.

Ten or twenty ounces of urine is taken, to which is added potassium or sodium carbonate until the mixture is alkaline. It is allowed to stand for half an hour and then filtered. The filtrate is agitated with two ounces of pure sulphuric ether. The ether is withdrawn, and to it is added one drachm of dilute hydrochloric acid of a strength of ten minims to the ounce. This is shaken with the ether and placed in an open dish, from which the ether evaporates spontaneously, a gentle heat being applied to obtain a perfect solution of any alkaloid on the surface or adhering to the sides of the dish. The remaining liquid may now be tested for cocaine.

A solution of terchloride of gold is made by dissolving ten grains of the terchloride in one ounce of water. This added to the ethereal extract will give, if cocaine be present, a yellow or yellowish-white precipitate. The precipitate is dissolved by heat in the presence of a little free acid. Upon boiling, the vapour given off has the odour of benzoic acid. The author states that if benzoic acid is present, it can only come from the presence of cocaine.

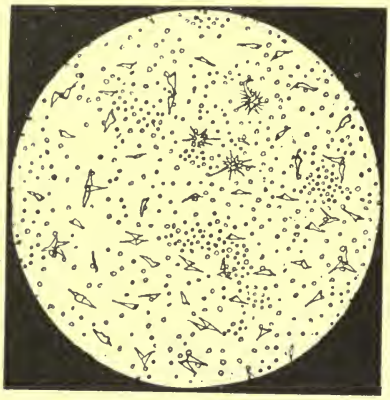


FIG. 54.—Cocaine Crystals.
As obtained by Myer's reagent under ⅛ objective, after Lett.

The test by Myer's reagent is as follows: To a portion of the residue left from the ether evaporation add a few drops of this test reagent; a white precipitate will at once be formed if cocaine is present, which dissolves by heat, and upon cooling throws down yellow crystals, which under the microscope ($\frac{1}{6}$ objective) appear as depicted in Fig. 54. If there is an excess of the precipitate the undissolved portion will fuse into yellow gummy masses upon boiling. In following out the test with Myer's reagent, should the patient be taking quinine, it will first be necessary to precipitate this alkaloid from the solution to be tested by picric acid in excess, filter, and make the test with the filtrate thus obtained. The limit of Myer's

reagent appears to be about one part of cocaine in 30,000 of water.

Cases.—The following cases are reported:—

(*a*) B.D., a Hindu pressman, aged 23, of Calcutta, was addicted to alcohol and to cocaine. On May 28th, 1912, he played cards with his friends up to a late hour of the night and distributed *pan* (betel) with cocaine to his companions, taking the largest share himself. He left the place soon after, and at 2.30 A.M. on the 29th he was found lying unconscious and groaning at a neighbour's doorway. Medical aid was summoned, the man was removed to hospital, but he died on the way there. Autopsy: Body poorly nourished; rigor mortis present; pupils normal; lungs, kidneys, brain, and the mucous membrane of the stomach were congested. Stomach contained about 2 ounces of recently taken food without any special odour. Cocaine was found in viscera and urine.—Dr. C. L. Bose, *Chem. Exam. Beng.*, 1913.

(*b*) K., a Hindu female, aged 28 years, a woman of the town, in the habit of taking cocaine, left home about 1.30 A.M., and returned at 6.30 A.M. a few hours later. She was seen to be staggering while washing her mouth at a hydrant hard by. Very soon afterwards, she lay down, became unconscious, and in a few minutes died. Autopsy showed body fairly nourished; rigor mortis present; pupils slightly contracted; no marks of violence on body. Brain and its membranes, liver, spleen, kidneys, ovaries, bladder and mucous membrane of the stomach were found congested. Right heart was dilated and contained dark fluid blood. The stomach contained about 3 ounces of recently taken vegetable food without special odour. Cocaine found in the viscera in marked quantity, and no other poison.

(*c*) M.K., a Hindu female, aged 20 years, lived with her husband in Calcutta. On the 17th October, 1912, she visited her sister-in-law, Lukhi, and at about 7 P.M. on the following day, she offered Lukhi some white powder which she believed to be a specific remedy for acidity and indigestion. They each took some of the powder, and within half an hour they became ill and then unconscious. Makhan died soon after, but Lukhi regained consciousness about 4 hours later and recovered.—Autopsy showed rigor mortis present; body well nourished; pupils slightly contracted; no external marks of violence. Brain, the meninges, and the lungs highly congested; liver, spleen, kidneys, larynx, and trachea also congested. Stomach contained food. Cocaine and no other poison present in the viscera. Death took place in this case in about half an hour.

(*d*) L.K., did not terminate fatally. The dose taken rendered the patient unconscious in half an hour and kept her so for four hours. Her pulse and respiration are said to have been normal during her stay in hospital, and her pupils slightly dilated. In the stomach-washings cocaine was detected, but no other poison.—Dr. C. L. Bose, *Chem. Exam. Beng.*, 1907.

Several chronic cases are reported in *I.M.G.*, 1902, 85.

Coal-Tar Derivatives.

Of the countless coal-tar derivatives many are used by patients on their own responsibility to relieve headache or procure sleep, and hence poisoning is not infrequent. Antifebrin, antipyrin, phenacetin, pyrogallol, sulphonal, and aspirin,

act as blood poisons, disintegrating the red blood-corpuscles and converting the liberated hæmoglobin into methæmoglobin.

Antifebrin or Acetanilide.—Five grains in an adult have frequently produced toxic symptoms with cyanosis and reduction of temperature. It is contained in 'headache' or 'Daisy' and other proprietary powders for the relief of neuralgia, etc.

Antipyrin produces similar symptoms occasionally. **Phenacetin** has in two instances at least caused death with cyanosis. One, a girl, died in a few hours after taking fifteen grains of phenacetin; and a boy after taking a fifth dose of fifteen grains within three weeks. **Pyrogallol** or pyrogallic acid causes dyspnœa, reduction of temperature and sensibility, paralysis, cyanosis. Four fatal cases from external application for psoriasis. Treatment.—Evacuation of stomach, administration of stimulants and external warmth, and inhalation of oxygen. **Naphthalene** may produce toxic effects even from external use, cyanosis and muscular twitchings. **Sulphonal** used as a hypnotic produces ataxia and death in large doses. It is cumulative. Death has occurred in a man aged 50 who took for four weeks doses of 7 to 22 grains, also in a woman aged 47 who took 15 to 22 grains almost daily till total reached over 2 ounces. The leading symptoms are staggering gait, thick speech, ataxia, paralysis of facial muscles, convulsions, coma, etc., and death from heart failure and probably uræmia. Urine is claret-coloured from hæmato-porphyrin as well as unchanged sulphonal. Treatment.—Empty stomach, give purgative and large enemata of warm water and alkalies.

Aspirin, or Acetyl Salicylic Acid. This acts as an irritant as well as cerebral poison. It is known to pass unchanged through the stomach and upper part of small intestine, and is then converted into fine salicylic acid.

Case.—Case of **Aspirin poisoning.**—A sergeant, U.S.A., aged 24, was admitted to the Thetford Military Hospital on October 25, 1918, with the history of having been taken ill two days previously with influenza. He was powerfully built and gave no history of previous gastric or intestinal trouble. He had been taking aspirin capsules of his own in addition to 18 5-gr. tablets given to him by the medical orderly. Instead of keeping to the prescribed dose, he had taken them all, together with a number of capsules, in the course of six hours, to the amount of nearly 200 grains. He did this in order to get fit quickly, as he was under instructions for France. He was markedly anæmic, temperature 101·4°, pulse 120. He vomited undigested milk, with no trace of blood. On October 26 the anæmia was more profound. Pulse 150—weak and irregular. An enema was administered with little result. The vomiting continued at intervals. Next morning a large quantity of blood was

passed by the bowels and he rapidly became unconscious. He died a few hours later.

Necropsy.—The last five feet of the ileum were acutely congested, and the cæcum and colon were loaded with blood clots. The line of demarcation between healthy and congested bowels was very definite. The small intestine was uniformly inflamed. The mucous coat had apparently disappeared, leaving the submucous coat and blood-vessels exposed and eroded. Bleeding from this large area had evidently been the cause of death. The other organs were healthy.—*Lancet*, January 11, 1919, p. 64.

Veronal or *Barbitone.*—This dangerous new soporific drug has caused several deaths in England. It is a urea-derivative, *diethyl-malonyl-urea,* and occurs as a white odourless crystalline powder. It is used by the laity like sulphonal and trional, but is now placed on the list of poisons. *Toxicity and fatal dose.*—Its medicinal dose of 5 to 10 grains sometimes causes giddiness and loss of muscular co-ordination. Toxic symptoms are reported after two doses of 10 grains each (*B.M.J.*, I. 1907, 250). Death has followed a dose of 15 grains, 90 to 105 grains (*B.M.J.*, II. 1909, 1154; *Lancet*, I. 1909, 1557), 170 and 232 grains (Ehrlich, *Münch Med. Woche*, 1907). Recovery in three days after 100 grains taken with suicidal intent (Taylor, *M.J.*, II. 616).

Symptoms.—In small doses, profound sleep; respiratory enfeeblement tending to respiratory paralysis; cyanosis; feeble pulse; variability of pupils and reaction to light. Under moderate doses, thirst, itching of legs and reddish-violet rash, or spots on the body; urine cherry-red in colour. Large doses, coma.

Treatment.—Emetics, followed by coffee, and strychnine hypodermically.

Post Mortem Appearances.—Generally those of irritant poisoning.

Detection.—Veronal is a colourless crystalline solid which melts at 182° C. The crystals, under a low power, are hexagonal prisms, and dissolve with difficulty in cold water, floating on top even on shaking, but dissolve in 12 parts of boiling water, and freely in alkaline solutions. To the solution thus obtained mercuric nitrate solution gives a white precipitate. The dry powder mixed with dry sodium carbonate and heated in a test tube, evolves ammoniacal vapours, detected in usual manner, colouring moist red litmus paper blue, and turmeric brown, when held in the mouth of the tube (H. Candy). A specific test is: A saturated solution of veronal acidified with nitric acid gives a white precipitate with Millon's Reagent, soluble in excess. A method of extraction and recognition in urine has been given in *Arch. d. Pharmacie*, 1904, 2426.—Martindale and Westcott, *Ext. Pharm.*, II., 1912, 359.

Cases.—(1) Mr. Trevanion, aged 27, addicted to the veronal habit, died from an overdose at Hove, in September, 1912, but whether there was suicide or foul play was not ascertained. Evidence showed that 150 grains were taken in coffee, and he was unconscious within about one hour.

(2) Man, aged 33, a heavy drinker, who had taken 100 grains with suicidal intent five weeks before and recovered in three days, took about 120 grains on early morning of June 29, 1909. At 9.45 A.M. he was deeply comatose, surface warm, respirations 32, pulse 102, mucus in throat, cornea insensitive, pupils moderately dilated, reflexes abolished. At noon still comatose, pupils contracted, winced on slapping face. 8 P.M., same; unable to swallow. 11 P.M., same, but pupils dilated and could swallow a teaspoonful at a time. July 1, 9 A.M., not quite so deeply comatose, winced on slapping face; as bowels not open, gave one minim croton oil; temp. 102·2°, pulse 110, reflexes still absent. 10 P.M., temp. 102·4°, finger nails dusky, breathing impeded by mucus, bowels not open, so calomel 5 grains. July 2, 9 A.M., better, could be roused to speak a few words, pupils dilated, temp. 102·4°, pulse good, reflexes absent, bowels still not open, soon asleep again. During day swallowed better, and could be roused by loud speaking. July 3, 9 A.M., condition same, temp. 102·8°, resp. 36, bowels still not open, croton oil one minim repeated, cornea and pupils insensitive, not any more rousable. 8 P.M., more comatose, temp. 103·2°, pulse 130, resp. 40. July 4, 2.30 P.M., temp. 104·2°, resp. over 40, pulse 150. Died 6.30 P.M., comatose. *P.M.* exam.: Nothing found except intense congestion of lungs, liver, spleen, and brain, due no doubt to the asphyxial form of death. Mucous membrane of alimentary tract congested, otherwise normal.—Dr. Durant, in Taylor, *M. J.*, 1910, II. 616.

Resorcin produces toxic symptoms like phenol. **Nitro-glycerine.**—This is a heavy, very explosive, oily liquid, almost insoluble in water, but soluble in alcohol, ether, and chloroform. Mixed with siliceous earth, it forms the explosive known as dynamite. Nitro-glycerine is a narcotic poison, acting more powerfully when inhaled in vapour than when swallowed as a liquid. In some persons, even minute doses cause violent headache. Several cases of poisoning by nitro-glycerine have occurred in Sweden, the symptoms being narcotic in character. In a case mentioned by Taylor, vomiting and purging were also present. **Benzene** or benzol, a liquid prepared by distillation from coal-tar naphtha, used in the arts as a solvent, is a powerful narcotic poison. Inhalation of its vapour has caused narcotic effects with twitchings of the muscles and convulsions. Taylor[1] records a case of a boy who swallowed about three ounces of coal naphtha and died in three hours. The symptoms were delirium followed by coma with contracted pupils. There was complete loss of muscular power and great difficulty in breathing. **Nitro-benzene,** artificial oil of bitter almonds or essence of mirbane, obtained by the action of strong nitric acid on benzene, is a liquid possessing the same odour as hydrocyanic acid, and a powerful narcotic poison. The symptoms produced by it are exactly the same as in poisoning by hydrocyanic acid, but with one remarkable point of difference, viz. that there is an interval generally of at least two hours, but sometimes longer, between swallowing or inhaling the poison and first appearance of the symptoms. Several deaths have been reported from swallowing nitro-benzene. In one case quoted by Taylor[2] a boy, *æt.* thirteen, swallowed a small quantity; no symptoms appeared for several (apparently eight) hours; he then suddenly became insensible and died four hours after the attack, or twelve hours after swallowing the poison. Blyth considers it probable, from recorded cases, that 15½ grains, or even less, would, if swallowed, prove fatal to an adult. Death also

[1] *Poisons*, p. 656. [2] *Ibid.*, p. 666.

has occurred from inhalation of the vapour, as in a case reported by Dr. Letheby,[1] in which a man, *æt.* forty-three, having accidentally spilt some nitro-benzene over his clothes, became comatose in four and died in nine hours. Bad effects even are said to have arisen from washing with soap scented with nitro-benzene, especially when hot water has been used.

Aniline dyes.—**Aniline** or Phenylamine, obtained by the action of nascent hydrogen (which may be evolved by the action of acetic acid on iron) on nitro-benzene, is a powerful narcotic poison, acting similarly to hydrocyanic acid. It is remarkable that the sulphate of aniline appears to be almost inert to man. Symptoms of poisoning, however, have followed from external application of the hydrochlorate of aniline and the use of brilliantly coloured clothing dyed by aniline.

It has long been known that it can readily gain access to the circulation through the lungs, respiratory passages, and digestive organs, and much evidence is accumulating that it may enter the system through the skin. In the body it undergoes partial oxidation, leading to the formation of amidophenol or its derivatives (a similar result occurs after the ingestion of acetanilide or antifebrin), and these bodies are capable of producing destruction of the red blood corpuscles, cyanosis, and dangerous collapse. The various aniline colours are mostly prepared from rosaniline, a red colouring matter usually manufactured by the action of arsenic acid on aniline, and liable therefore to contain arsenic. There is some reason to believe that certain of these dyes, even if free from arsenic, may produce ill effects. Aniline dyes, therefore, should never be used for colouring articles of food. They have, however, been used to colour confectionery, and Chevers mentions the use by native females of red aniline dyes for painting the lips, and refers to a case of poisoning in a child from this practice. Essence of peppermint has been found coloured. MM. Landouzy and Brouardel in 1900 recorded in the *Bulletin de l'Académie de Médecine* ten instances in which the wearing of yellow boots by children had been followed by very grave symptoms. In every case the colour of the boots was due to their being stained with a liquid containing aniline.

Cases.—An infant, 17 months old, was taken out of doors for an airing. Under these circumstances it was accustomed to be very lively, but on this particular occasion its general demeanour underwent an extraordinary change, its face became pale and blue, it fell into a deep sleep, and shortly became quite insensible. After two hours of vigorous treatment, the child, which had appeared to be dying, recovered. A few days elapsed, and then a brother, aged six, was taken out for a walk shod in a similar manner. Three hours later he returned apparently thoroughly chilled and looking very blue. The cyanosis passed off after a few hours, but his face did not regain its ordinary appearance until the following day. On a subsequent occasion a similar outing was followed by a similar train of phenomena. Eventually it was discovered that the fluid which had been used for staining the boots contained aniline, and it was recognized that the cyanosis resembled that seen in aniline makers. Not long after these cases were reported it was ascertained that six out of seven children of one household had developed similar symptoms after wearing yellow boots. They suddenly became ill, complained of chilliness and exhibited pallor of the face with blueness of the lips and hands. Three of them remained unconscious for several hours;

[1] Taylor, *Poisons*, p. 666.

the heart's action became very feeble, and the urine contained a trace of albumen. In still another case the cyanosis was so profound that a diagnosis of morbus cæruleus was made and attributed to a sudden reopening of the foramen ovale. Analysis showed that the liquid used to give colour to the boots contained 90 per cent. of aniline. When it was injected subcutaneously into young guinea-pigs and rabbits they developed identical symptoms in from fifteen to thirty minutes. The same results occurred, but more slowly, when it was given by the mouth. Similar toxic symptoms appeared when a few drops of the liquid were placed on the nasal and buccal mucous membranes; also when the animals were made to inhale the vapour from the heated liquid, and after painting it over a considerable area of shaved skin. In the latter case some of the animals died within thirty-six hours. The red blood corpuscles decreased in number, and the spectroscope showed the characteristic absorption band of methæmoglobin. Further experiments revealed the fact that absorption by the skin occurred with special facility in a moist and heated atmosphere. An instance was recently reported of an American girl who was poisoned by the ink used on type-writer ribbons. She stained her fingers with the ink, and thus conveyed some of the latter to a sore on her upper lip. Acute toxic symptoms subsequently quickly developed, associated with great œdema and pain locally, and a fatal result shortly afterwards ensued.

Detection of Aniline.—*Aniline* (1) with sulphuric acid and manganese dioxide, or lead peroxide, gives a green colour, changing to a persistent blue, and then to black; and (2) with solutions of hypochlorites, *e.g.* chloride of lime, gives a blue or violet colour, soon changing to brown. *Nitro-benzene* may be recognized by converting it into aniline and applying the above tests. The conversion may be effected by dissolving the nitro-benzene in alcohol, and adding hydrochloric acid and zinc. From the acid liquid, after driving off the alcohol, aniline may be separated by neutralizing the liquid with carbonate of soda, and shaking the neutralized liquid with ether. The ether is then separated, allowed to evaporate, and the residue tested for aniline. Benzene is detected by converting it first into nitro-benzene, by treatment with nitric acid, and then into aniline as above. From organic mixtures benzene and nitro-benzene may be separated by distillation. If the matters to be distilled are first acidulated with sulphuric acid, aniline, if present, will be found in the residue left in the retort, and may be separated from it by Stas' process (see p. 545), using ether as a solvent. Nitro-benzene may become changed in the body into aniline.

Carbolic acid or **Phenol.**—Phenic acid or phenyl alcohol, obtained from coal tar, is largely used as a disinfectant and is sometimes used for suicide. It is the active ingredient of many disinfecting powders, *e.g.* Calvert's, which contains free carbolic acid mechanically mixed with siliceous matter, and separable from it by distillation; and Macdougall's, which contains carbolic acid in combination with lime, calcium sulphite being also present. From Macdougall's powder, carbolic acid may be separated by decomposition with dilute hydrochloric acid. Carbolic acid is a powerful poison, causing, when swallowed, burning pain in the mouth and throat, whitening and hardening of the lining membrane of the mouth,

and occasionally vomiting. Insensibility speedily follows, passing into coma, with stertorous breathing and contracted pupils. The urine is suppressed or scanty, and of a dark or olive-green tint. FATAL DOSE.—Death has occurred in ten minutes; the usual fatal period, however, is one to four hours. One and a half teaspoonfuls of the concentrated acid has caused death, and in four cases out of five, 15 grammes (231½ grains) proved fatal to adults. Half an ounce is almost always fatal. Dangerous symptoms may be caused by six or seven drops, and death has resulted from its external application with gangrene, especially in lower extremities. *Resorcin*, a substance closely allied to carbolic acid, and like it used as an antiseptic, has a similar toxic action. *Detection.*—(1) The odour of carbolic acid is characteristic, and may be recognized during life in the patient's breath, urine, or vomit, and after death in the tissues. (2) Slips of some kinds of pine wood, moistened first with carbolic acid and then with hydrochloric acid, acquire a blue colour. The pine wood should always be tested first: (*a*) with hydrochloric acid only, and (*b*) with carbolic acid and hydrochloric acid, as some varieties give a blue colour with hydrochloric acid only, and others do not give a blue colour with carbolic acid and hydrochloric acid. (3) If to a solution of carbolic acid one-fourth of its volume of ammonia be added, and then a minute quantity of a hydrochlorite, a blue colour is produced, turning red with acids; warming hastens the development of the blue tint. *Treatment.*—Alcohol is alleged to be a chemical and physiological antidote.[1] Wash out stomach with Epsom salts, and give half-ounce doses of sulphate of magnesia and sulphate of soda. The soluble sulphates combine with the carbolic acid to form harmless sulpho-carbolates. Olive oil in large doses—*e.g.* a couple of wine-glassfuls. The 1·50 grain of sulphate of atropine may be given hypodermically.

Case.—**Carbolic acid poisoning by absorption.**—A Plaistow man on leaving his work put a quart bottle of carbolic acid in his pocket. The glass was thin and the bottle broke. He wiped the acid off his body with a handkerchief, which he threw away. He then got into a motor 'bus, and remembered getting out at Greengate, but after that he knew nothing more. He was taken home and died. The medical evidence at the inquest showed that the acid had been absorbed through the pores of the skin and had thus poisoned the man.—*Morning Post*, September 8, 1907.

[1] A. M. Phelps, in the *New York Medical Journal* of January 14, 1899, calls attention to *the marked antagonism between alcohol and carbolic acid.* He states that he has frequently seen Dr. Powell, at the Post-Graduate Hospital, pour upon his hands some pure carbolic acid and in a few minutes wash it away with alcohol, and no escharotic action followed. At the present time he frequently flushes abscess cavities by washing them out with pure carbolic acid, and a few minutes later with pure alcohol. Phelps is of the opinion that we have in alcohol a specific against the escharotic action of pure carbolic acid.

Tri-nitro Toluol or **"T.N.T.,"** a product in the manufacture of high-explosive shells in munition factories, causes by its fumes, staining and corrosion of the skin and mucous membranes, falling of hair, and sometimes even death, in spite of protective masks.

Picric or **Carbazotic acid.**—A yellow crystalline substance, having a bitter taste, a great calorific power; and creosote, a mixture of phenols (aromatic alcohols homologous with carbolic acid) obtained by distillation from wood tar.

Petroleum or **Kerosene.**—This is a mixture, occurring in nature, of hydrocarbons of the paraffin series. From it by fractional distillation are obtained various liquids. Of these the lighter are known under the names of *Petrol, Gasoline, Benzene, Mineral Naphtha,* and *Petroleum-ether* or spirit; the intermediate portions form the kerosene oil of commerce used for lighting purposes, and the heavier portions are used for lubricating machinery. A few cases of poisoning by petroleum are recorded, the symptoms being those of narcotic poisoning, death occasionally resulting from cardiac failure (case below). In India the majority of cases are in children under three crawling over the floor and drinking kerosene oil by mistake for water. Narcotic effects have also been produced by inhalation of the vapour. **Symptoms** of kerosene poisoning.—Irritant vomiting, followed by signs of collapse, chiefly circulatory. Odour of the breath markedly that of kerosene. **Treatment.**—The stomach should be washed out with warm water; if in children, an ordinary soft rubber male catheter being employed instead of the ordinary tube, which is too large. Other treatment is mainly symptomatic. The child should be kept under observation for at least twelve hours, and the possibility of a sudden fatal issue never lost sight of.

Case.—**Kerosene oil poisoning.** — Hindu male, aged 20 months, said to have drunk a quantity of kerosene oil from a lamp about two hours previously, and to have vomited ten times at home. Patient is collapsed, unconscious; pulse feeble, rapid, 150; respirations 54; abdomen distended. Stomach was washed out and washings possessed distinct odour of kerosene. Patient recovered consciousness after this procedure. Stimulants were given freely, and the general condition slightly improved, but child died suddenly next morning. Autopsy showed no lesion to account for death.—C. R. Milne, *I.M.G.*, 1902, p. 210.

Turpentine oil or spirits.—Several slightly differing varieties of oil of turpentine exist, all being terpenes, or hydrocarbons of the formula. A few cases of poisoning of children by oil of turpentine, two of them fatal, are recorded by Taylor,

the symptoms being those of narcotic poisoning. In the two fatal cases the dose was about half an ounce; the children were respectively three and five months old. Taylor also mentions a non-fatal case of poisoning in an adult by camphine, or rectified oil of turpentine, in which vomiting and purging were present. Turpentine, it may be noted, is excreted by the kidneys and communicates to the urine a smell of violets; painful micturition and hæmaturia may result from its action on the urinary organs.

Deliriants.

The majority of the more important of these are 'mydriatic deliriants' belonging to the N.O. *Solanaceæ*.

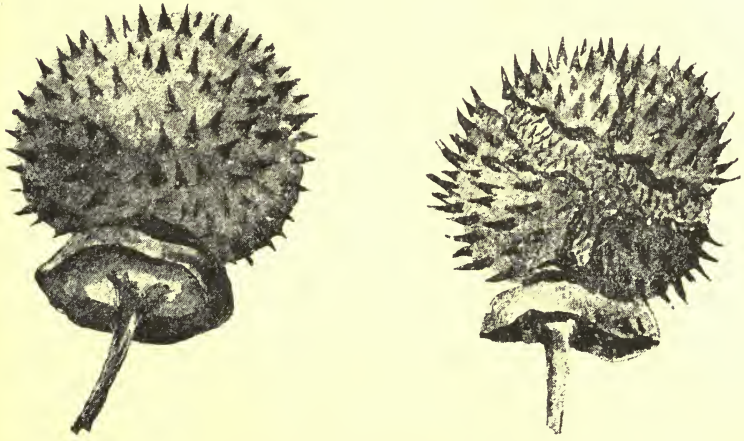


FIG. 55.—Datura Capsules (*D. alba*) ¾.

Datura fastuosa (Linn.) and variety *alba* (Nees), white-flowered (*safed dhattura*) and purple-flowered datura, *Kala dhattura* (Hindi) *Umattai* (Tam.), common in India; and Datura stramonium, or Thorn-apple, indigenous in England, and officinal B.P. The seeds, leaves, and probably other portions of these plants, contain the poisonous alkaloid daturia or daturine, now regarded as identical with atropine.

Datura or 'Thorn-Apple.'

Datura poisoning is common in India, especially to facilitate theft. It is the poison used by the *Thugs*, the strangling poisoners. The seeds are usually employed; but a few cases of poisoning by the leaves have, however, been reported.

Frequency of Datura-poisoning.—In Bengal, etc., in the three years ending 1872, the seeds were administered in seventy-seven cases, affecting one hundred and twenty-three persons; and the Bombay Analyzer's reports for the ten years ending 1885, show that datura was detected during that period in seventy cases, affecting one hundred and thirty-eight individuals. In the great majority of cases of datura poisoning in India, the motive of administration is facilitation of theft. When, in fact, in India, an individual has been first drugged and then robbed, it will usually be found that datura has been employed. Sometimes, however, arsenic or cannabis is used. A common form of theft by aid of datura is road robbery by professional highwaymen, and in such cases a hollow pestle is sometimes used by the disguised robbers, the cavity of which contains datura or arsenic, and the inversion of this while pounding grain, etc., with it, introduces the poison into the food without exciting suspicion.[1] Occasionally the motive of administration is other than aid to theft. It is of course possible that in some cases datura is given with homicidal intent. It rarely, however, happens that there is any ground for suspecting this; in fact, there seems to be a widespread popular belief in India that datura is simply an intoxicant, and not a poison, and certainly many of the cases do recover. Road-poisoners sometimes partake with their victims of the drugged food, which they would hardly do if aware of the danger of fatal results. Commonly, where datura is used for criminal purposes in India, the poison is mixed with sweetmeats or food, but in exceptional cases the poison seems to have been mixed with tobacco given to the victim to smoke. *Suicidal* poisoning by datura is extremely rare (see *Case*, p. 648). *Accidental* cases among children are sometimes met with. Lastly, it may be mentioned that datura is said to be used in India by vendors of native liquor, for the purpose of conferring additional intoxicating power on their wares. A method said to be followed in Bombay, is to pour the liquor into a vessel which has been first filled with the smoke of burning datura seeds.[2]

Symptoms.—These generally are like those of Belladonna (which see). They are in two stages, namely, delirium, and then coma. The symptoms develop rapidly: If a decoction of the seeds has been swallowed, they may appear almost immediately. Usually, however, there is an interval, commonly not more than half an hour, between swallowing the poison and

[1] Dr. W. Center, *Ind. Med. Gaz.* for 1874, p. 116.

[2] The occasional presence of datura in majun is mentioned; see 'Cannabis,' p. 644.

first appearance of the symptoms. The first symptom noticed is dryness of the throat; this is followed by giddiness, staggering as if intoxicated, flushing of the face, and delirium with widely dilated pupils. The dryness of the throat increases, and swallowing becomes difficult, the difficulty seeming to depend, at any rate partly, on spasm of the pharyngeal muscles. The voice becomes changed, articulation becomes indistinct, and in one case mentioned by Taylor (from *D. stramonium*) the power of speech was lost. The vision becomes indistinct or disordered. *Hyperpyrexia* is sometimes, perhaps often, produced. In three separate cases of poisoning by *daiura* that occurred in the Hissar District in 1916 [1] remarkably high temperatures were recorded, viz. 105·4°, 107·4°, and 108° respectively. The first case (a female) recovered, the other two (males) died. It is known that hyperpyrexia occurs in poisoning by the alkaloid *atropine*, which is chemically identical with the alkaloid *daturine*, found in *datura*, but it does not seem to be generally recognized that high temperatures may also occur in poisoning by the latter. The delirium is peculiar in character. The patient is restless; often wanders about, talks incoherently, or mutters indistinctly, but at the same time is timid and easily controlled. He goes through various ludicrous movements, appears to grasp at imaginary objects, picks at his clothes or bedding, and often appears to be trying to pull imaginary threads out of the ends of his fingers. These symptoms either gradually disappear or are succeeded by a stage of soper with *subsultus tendinum*, deepening into coma, sometimes accompanied by convulsions, followed by gradual failure of the heart's action and respiration and death. Dr. Giraud, in two out of four cases of deep coma, found a remarkable tympanitic condition of the abdomen to be present. If the case tends towards recovery, the sopor passes away, and is succeeded by a stage of secondary delirium lasting about six to ten hours, and in character similar to the primary delirium of the first stage. The pupils are widely dilated throughout the illness.

Fatal dose.—This cannot be stated with certainty. Waring, however, writing of the tincture of the seeds (strength 1 to 8), considers twenty drops to be equal in effect to one grain of opium.[2] On this basis, a minimum fatal dose of the seeds would be about ten to fifteen grains, and a case is reported in which a decoction of 125 *D. stramonium* seeds, equal to about sixteen grains, caused the death of an adult in seven hours.[3]

[1] Black, *Panjab Chem. Ex. Rept.*, 1916.
[2] *Pharmacopœia of India*, p. 176. [3] Taylor, *Poisons*. 774.

The leaves are less active than the seeds. One hundred seeds of *D. alba* weigh about twenty-one grains; of *D. stramonium*, about twelve and a half grains, and of *D. fastuosa*, about ten grains.

Mortality.—Dr. Giraud (in 1848) met with only one death in fifty-one cases admitted into the Jamsetjee Hospital, Bombay; and in the ten years ending 1885, of fifty-nine cases admitted into the same hospital, only two died. This, however, is an exceptionally low death-rate. Dr. Brown, of Lahore, records twenty-one deaths in ninety-two cases. In one hundred and twenty-three Bengal cases, twenty deaths were reported; and of the Bombay Analyzer's one hundred and thirty-eight cases, twenty-four died. These last three sets of figures give a total of sixty-five deaths in three hundred and fifty-two cases, or just under 18½ per cent.

Post mortem signs.—These are usually wide dilatation of the pupils; congestion of the brain and its membranes, and often also of the lungs and abdominal viscera. The mucous membrane of the stomach and intestines may be found congested, and patches of extravasated blood have been met with in the large intestine. Seeds, or fragments of the seeds (see *Detection*), may be found in the contents of the stomach or intestines.

Treatment.—Administer emetics, or use the stomach-pump; and treat the symptoms, as they arise, on general principles, *e.g.* if the pulse is feeble, and the skin cold, give stimulants; if narcotism is present, use cold affusion, etc., as in opium poisoning; employ artificial respiration if necessary. Opium, or, better, morphia, hypodermically, may be given if there is much excitement. Opium, however, is less efficient as an antidote in atropine poisoning than atropine in opium poisoning. Lauder Brunton recommends the cautious administration of *physostigma*; and Ringer and others advise, in atropine or stramonium poisoning, administration of *pilocarpine nitrate* in quarter to half-grain doses.

Detection and tests.—Datura seeds are *ear*-shaped, and somewhat reniform with rounded, thickened, furrowed, wavy margins strongly compressed laterally, from one-sixth of an inch to one-fifth of an inch broad, and about one twenty-fifth of an inch thick. *Datura alba* (*Nees*) of India has rather small subglobular and sharply spinous capsules, and irregular triangle yellowish-brown, roughish seeds, which are used like those of the preceding species. The seeds of *Datura stramonium* are black. *Datura metal* (*Linn.*), which grows in Africa and

Southern Asia, has obliquely cordate, somewhat sinuate-toothed or nearly entire, soft-hairy leaves, and pendulous, spiny capsules, with brownish-yellow seeds, and, to a certain extent, resemble capsicum and tomato seeds.

Seeds suspected to be datura, when found in vomited matter or in the alimentary canal, require to be carefully distinguished from the somewhat similar seeds of *capsicum* and *tomato*, both of which are extensively used as food in India.

FIG. 56.—Sections of Datura Seeds (*enlarged*).

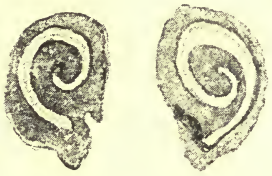


FIG. 57.—Sections of Capsicum Seeds (*enlarged*).

Under the microscope they present characteristic differences. Whole seeds or large fragments may readily be differentiated as follows :—

(1) Datura seeds are double-edged at the convex border ; capsicum seeds are not.

(2) Capsicum seeds have a sharp, pungent taste; datura seeds are feebly bitter, but not pungent.

(3) If the seeds are laid on the flat, and divided horizontally, the embryo of a datura seed is seen to differ in shape from that of a capsicum seed (see Figs. 56 and 57) ; it is embedded in a white, oily albumen, and presents a specific curve like the head of a shepherd's crook. The exosperm of the pulverized *datura* seed is cavernous under the microscope, whilst the *capsicum* embryo is embedded in a fleshy albumen and recurved like the figure 6 or 9, in which the curve from its point is like a commencing spiral.

From organic mixtures, or the powdered seeds, the alkaloid may be separated by Stas' process, using ether as a solvent. It will be found, when dissolved in a little very dilute acid, (1) to respond to the group tests for alkaloids, and (2) when applied to the conjunctiva, to cause dilatation of the pupil. (See also *Hyoscine*, p. 650.)

There are no special chemical tests for daturine (or atropine) ; the physiological test (action on the pupil) is, however, extremely delicate. In man, an atropine solution of 1 to 120 commences to act in six or seven minutes, and its effect continues more or less for several days. A solution even of 1 to 48,000 will slowly cause dilatation. Herbivora, and especially the rodents, are much less sensitive than man to the action of atropine.

The following note on testing for datura is contributed by Dr. E. H. Hankin :—

The cat is the most convenient animal to use in testing for datura. A drop of the solution to be tested is placed in the eye. After half an hour the animal is examined. It should be examined at first in a room. If no dilatation is observed, it should be taken out of doors into the sunshine and held with its eye facing the sun. The pupils contract. The pupil to which the solution has been applied will contract less than the other if datura is present. If even under these conditions no dilatation is visible, the treatment of the eye with the suspected solution should be repeated two or three times at intervals of an hour. It is advisable to commence experiments on the cat with a somewhat dilute solution, as a too strong solution, by producing excessive and lasting dilatation, may render the cat unfit for further use for perhaps a couple of weeks, besides giving the animal unnecessary discomfort. Road poisoners who use datura have no use to kill their victims, and commonly use the minimum dose requisite for their purpose. Chinese robbers in the Malay States are stated to be able to so adjust the dose that the victim will become unconscious after walking either one, two, or three miles from the liquor shop where the poison was administered. It not infrequently happens that in cases where there is ample proof that datura has been employed, none can be detected on chemical examination. If a number of persons have been poisoned at the same time, as happens not infrequently with pilgrims, it may happen that examination of the vomit of each person separately fails to reveal the presence of datura, while if the residues of the vomits are mixed together, so that a larger amount of material is extracted, a substance having the properties of datura is detected. A further difficulty in detecting datura depends on the fact that the victims of road poisoners frequently vomit in the open air, and the asserted vomit sent in to the police is received mixed with an excessively large quantity of earth. A case is recorded from the United Provinces in which the vomit mixed with earth formed a package that was too heavy to be carried by four coolies.

Cases.—**Datura poisoning; road robbery; multiple homicide.**—(*a*) In 1899 the dead bodies of three Bengali men, evidently pilgrims, were found at a place near Buddha Gaya, and it was thought that they had died either of heat apoplexy or of cholera. The civil surgeon, who made the *post mortem* examination on these bodies, found the brain, lungs, and liver deeply congested and suspected poisoning, but he deferred giving any opinion as to the cause of death, pending the results of chemical analysis. Suspicion of foul play also arose from the fact that the deceased persons were seen in the company of another who had disappeared. Analysis revealed marked quantities of atropine in the viscera of each of these three persons.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899. (*b*) Two merchants started with a sais from Hubli in the Dharwar Collectorate, on an expedition to buy cotton in the neighbouring villages. As they were starting, a man and a woman offered themselves as guides, stating that they would show them where cotton was to be had. At a halt, food was prepared by the woman, of which the merchants and the sais partook; all three became insensible, and were robbed. One of the three died.—*Bo. Chem. Analyser's Rept.*, 1878–79.

Cases.—**Datura poisoning; robbery.**—(1) In 1899 a Hindu prostitute in Calcutta was visited on the night of the 10th September by two men previously unknown to her. At about midnight the men left, and the woman was afterwards found lying unconscious in the room and her house robbed. She was admitted into the Medical College Hospital

next morning in an unconscious condition. Her stomach was washed, and the washings were forwarded for analysis. Atropine and alcohol were detected in the liquid. The woman recovered. The accused were afterwards traced by the police and tried at the Alipore Sessions Court, and were convicted and sentenced to long terms of imprisonment. During the trial it was found out that they had committed similar offences on several previous occasions with a view to robbery.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(2) (Chevers, *Med. Jur.*, p. 155). In 1852, two men, Joogul and Pertab, went at night to the house of Pearee, a prostitute at Meerut. Joogul arranged to pass the night with Pearee, and, having paid her eight annas in advance, went away, but shortly afterwards returned with some sweetmeats, part of which he gave her. Pearee, soon after eating the sweetmeats, began to feel ill, and suspecting that she had been drugged, went to the door and informed a chowkeedar, who kept watch outside the house, and in the morning sent for the police. The police, on arrival, found Pearee insensible, and arrested Joogul in the house, and afterwards arrested Pertab. On the trial the prisoners confessed that they had arranged that Joogul should give the woman sweetmeats with which datura had been mixed, so that they might rob the house while she was insensible.—(3) (*Bo. Chem. Analyser's Rept.*, 1883).

Cases.—**Datura poisoning; motive other than theft.**—(1) In a case from Amraoti a man and his mother, after eating some food prepared by the wife of the former, were attacked by symptoms of datura poisoning; both recovered on the third day. The wife was arrested, and confessed to having put datura into some cooked *bhaji* (vegetables), which she had given to her husband and his mother. A portion of the *bhaji*, sent for examination, was found to contain daturine. The accused also stated that she had put arsenic and aconite root into some bread, which she had given to the two sufferers. In neither case, however, were any symptoms of arsenic or aconite poisoning present, and no trace of either of these poisons could be found in a portion of the bread submitted for examination.—(2) (*Bo. Chem. Analyser's Rept.*, 1884.) In a case from Bagevadi (Kaladgi District), daturine was found in some sweetmeat given by one man to another, who, after eating a portion, suffered from the usual symptoms of datura poisoning. The motive in this case was stated to be to make the victim "mad on account of kept women."

Case.—**Datura poisoning; suicidal.**—The assistant-surgeon of Ghatal reported a case in which a young Hindu female took datura seeds to commit suicide, in consequence of a quarrel with her father-in-law. A quantity of datura seeds were found by the side of the deceased. The viscera were forwarded for examination, and atropine was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Case.—**Fatal trial by Datura ordeal.**—In 1899, an old Hindu woman, Radhika Goalin, of the milkman caste, aged about 60, residing in Hario village of Monghyr district, was believed to be a witch, and her fellow-villagers deputed a professional exorcist (*ojha*) to find out whether or not this belief were true. The man gave her some prepared treacle to eat. Soon after taking this the woman developed narcotic symptoms, and died within twelve hours. The Civil Surgeon of Monghyr who made the *post mortem* examination forwarded the viscera of the deceased for chemical analysis. Atropine was detected in the viscera. It is common superstition in the country that witches withstand the action of poisonous drugs.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Cases with recovery—under Pilocarpine.—(1) Onkari girl, aged 3 years, was brought to hospital unconscious. Pulse breathing very feeble. The girl had eaten fresh and unripe fruits of datura, mistaking them for *sarifa* (custard apple) or *seetaphal*, which grew almost wild there. An injection of strychnine was given and the child somewhat revived. The stomach was washed out. A large quantity of chewed-up datura fruit with reddish-brown pulp and seeds were extracted, which were afterwards dried and weighed, and the result obtained was about 2 drachms. The shock of the pumping appeared to produce collapse. Pulse could not be felt and breathing stopped. Artificial breathing was at once resorted to, and breathing restored after about half a minute. Another injection of strychnine was given, the child revived, respiration remained troubled and pulse better for some time, but again the child began to sink. A dose of brandy ($\frac{1}{2}$ drachm) was at once poured down the throat, and steady friction over the extremities used, pulse became better and breathing fair, but the child did not recover consciousness. Cold affusions were used, but without any appreciable effect. *An injection of pilocarpine nitras $\frac{1}{12}$ gr. was given to counteract the effect of daturine; the result was marvellous, the child opened its eyes after a few seconds.* Another injection after half an hour, and a still further improvement was at once seen. Five injections of pilocarpine nitras were given in succession within 4 hours of $\frac{1}{12}$ gr. each; after the third injection the child was better.

(2) Girl, aged about 7 years, ate unripe fresh fruits of datura, mistaking them for custard apples. Stomach pump extracted a quantity of datura seed and pulp, weighed afterwards and found to be about half a drachm. The child, however, began to sink, and an injection of strychnine given at once. Two injections of pilocarpine nitras of $\frac{1}{6}$ gr. each were sufficient to revive her consciousness, and cold affusions with forced walking were also employed. The child survived and was discharged the next day.—G. M. Mukopudhya, *Ind. Med. Gaz.*, 1913, 310.

Belladonna.

All parts of the *Atropa belladonna*, or deadly nightshade, indigenous in England, contain atropine. Cases of poisoning by belladonna are occasionally met with in England, and are usually accidental, arising either from eating the berries in ignorance of their poisonous nature, or from mistakes in dispensing or using medicinal preparations. Accidental cases of this last description have been reported in India. Symptoms are similar to those of datura poisoning, all the secretions are lessened except the urine; in several cases a scarlet rash on the skin has been observed. Recovery is frequent: in over sixty cases of belladonna and atropine poisoning tabulated by Woodman and Tidy, there were only fourteen deaths. Death has been caused by a few of the berries; and two of the berries, and three grains of the extract, have each caused bad symptoms. Death also has resulted from the application of atropine to a blistered surface.

Doses.—Ordinary medicinal doses are: of atropine, $\frac{1}{100}$th to one twenty-fifth part of a grain; of extract of belladonna, $\frac{1}{4}$ to one grain; and of the tincture (strength, one of leaves to twenty of proof spirit), 5 to 20 minims. *Post mortem* signs and treatment are the same as in poisoning by datura. **Detection.**—The flowers have a bell-shaped corolla about one inch in length, dull reddish-purple in colour, and pale green at the base. The berries are rounded, about three-quarters of an inch in diameter, purple, black, and shining. The seeds are small, about one-tenth of an inch in diameter, and studded with projections. Organic mixtures may be subjected to Stas' process.

Scopolia lurida leaves and stalks were eaten by Gorkhas in the Black Mountain campaign in mistake for a Nepalese vegetable and caused poisoning symptoms like belladonna.—A. J. Macnab, *Ind. Med. Gaz.*, 1903, p. 365.

Hyoscyamus or Henbane.

Three species of hyoscyamus are found on the northern borders of India, namely, *H. niger* in the temperate Western Himalaya, *H. pusillus* in Western Tibet, and *H. muticus* or *insanus* in the Western Panjab, Sindh and Baluchistan, dis-

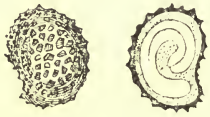


Fig. 58.—Hyoscyamus Seed and Longitudinal Section.
Magnified 7 diameters.

tributed to Kabul and Asia Minor, whence the Indian name for the seeds of the latter, *Khorasani-ajwan* (Hind.) or *Khorasani-owa* (Bom.). The latter species, from its deliriant and intoxicating properties, is known as *Koh-i-bhang* or mountain-hemp, from a fancied resemblance to Indian hemp; and is said to be smoked in small quantities by debauched *fakirs*, and to be used by evil-disposed persons to injure those with whom they had a quarrel. It was described as causing dryness and constriction of the throat, and furious delirium. In Sindh, writes the Commissioner, in 1894, regarding *H. muticus*, Baluchis, who use it as an intoxicant, dry the leaves and flowers and smoke the mixture exactly like *ganja*. But it is very powerful and makes them positively mad. Under its influence they strip themselves naked and dance about like lunatics. It grows wild about the Khirtar Mountains, where

it flowers in March. I have ascertained that it is used in this way all along the Sindh border. Baluchis and Sindhis (and especially those of mixed Sidi and Baluch breed, calling themselves Gaddos or Khaskelis, the descendants of slaves) are addicted to hemp drugs, which are grown or manufactured in Sindh on the Munchar Lake, and the use of henbane is stimulated by the sale of the hemp drugs being a monopoly and the drugs themselves more expensive. All of these Indian species of hyoscyamus contain a poisonous alkaloid *hyoscyamine* and *hyoscine*, resembling atropine in action, but weaker.[1] The leaves of *H. niger* are officinal in both Indian and British Pharmacopœias. **Dose.**—Ordinary medicinal doses are: of the extract (of the leaves) five to ten grains; and of the tincture half a drachm to a drachm. Of hyoscine a fatal dose is a quarter to half a grain. **Symptoms,** generally like *datura*, some delirium and excitement at first, followed by drowsiness, unconsciousness with complete paralysis, and in fatal cases death in a few hours. A few (not Indian) cases of poisoning by hyoscyamus have been reported. In one, a woman suffered severely, but recovered from a dose of eleven drachms of the tincture; and in another, six adults, of whom one died, were poisoned by eating the roots in mistake for parsnips. In a third, two boys, one of whom died, were poisoned by the seeds. **Treatment** as in datura poisoning. **Detection.**—Dymock describes the bazaar-seed as "reniform—laterally compressed, equal in size to that of *H. niger*[2] (see Fig. 58), of a light brown or grey colour; the testa is finely reticulated. The albumen is oily. The embroyo curved like the figure 9, the tail of the nine being represented by the radicle. The taste is oily, bitter, and acrid." Hyoscyamine applied to the conjunctiva dilates the pupil, and may be recognized, but not distinguished from atropine, by this property. It may be separated from organic mixtures by Stas' process as for atropine, and *hyoscine* can be distinguished from atropine and hyoscyamine by the bromine test.

Hyoscine Poisoning.—Crippen Case.—An American quack charged, October, 1910, with murder of his wife by hyoscine, and brutally cutting up her body into small pieces, burying it under the floor of a house in Hilldrop Crescent, London. Identification was made through the scar of an old abdominal operation and the identity of the pyjamas in which some of the remains were wrapped with those of the accused. Two-sevenths of a grain of *hyoscine* were found by Dr. Wilcox in the viscera examined. The hyoscine was determined to be such undoubtedly by the bromine test. Accused paid the death penalty.

[1] Dr. T. E. Stocks, I.M.S., in Hooker's *Jour. Bot.*, 1852, p. 1781.
[2] See Report by W. Dunstan in *Agricult.* Ledger, 1879, No. 5.

Solanine.

This is a poisonous narcotic alkaloid contained in the stalks and berries of the potatoes and other plants belonging to the genus solanum, N.O. *Solanaceæ*.[1] A few cases of poisoning by plants containing solanine are on record. In many of the cases there have been thirst, vomiting, and purging. Usually severe nervous symptoms are present, *e.g.* convulsions, delirium, and coma. Dilatation of the pupils has also been reported, but, according to Lauder Brunton, solanine is entirely without action on the pupil. The following species may be specially mentioned :—

Solanum tuberosum, or Potato.—A fatal case in a girl *æt.* fourteen from eating the berries of the potato is reported; and another, in which four persons, all of whom recovered, were poisoned by eating potatoes which had commenced to germinate. Mature potato tubers ordinarily contain only a trace of solanine, 0·06 per cent., but occasionally contain more, and so cause poisoning. Sixty-six soldiers at Pfuhls were poisoned by potatoes which contained 0·38 per cent. of solanine when raw, and 0·24 when cooked; and the symptoms included severe jaundice, and in one case convulsion (*Med. Press and Cir.*, 5th June, 1901). Solanum dulcamara, bitter-sweet or *Woody nightshade.*—This, a common hedge plant in England, is officinal in the British and Indian Pharmacopœias. A child *æt.* four is said to have died from eating only two of the berries. According to Dymock, the dried fruit is imported from Persia into Bombay, where it is known under the name of *Anabe-s-salib.* Solanum nigrum, or garden nightshade, *Makoi* (Hind.), *Kamuni, Ghati* (Bom.), *Manattakkali* (Tam.), *Kakmachi* (Beng.).—This, found in gardens in England, is common wild in India. Woodman and Tidy cite two cases (both in Europe) of poisoning of children by the berries; in one, two were poisoned and one died; in the other, three children, all of whom died, were poisoned. A case also recently occurred in Karachee, in which three children, one of whom died, suffered from symptoms resembling those of datura poisoning after eating food with which *Solanum nigrum* berries had been mixed.

Indian Hemp.

Indian hemp, or *Cannabis sativa,* N.O. *Urticaceæ* (see Fig. 59), when grown in India, differs so widely in medicinal properties from the same plant grown in Europe that it formerly was regarded as a distinct species, hence the old name *Cannabis Indica.* It is met with in the bazaars of India in four forms, viz.: (1) *Bhang, siddhi, sabzi,* or in pahariya *atar,* the dried leaves and small stalks; (2) *Ganja,* the flowering tops; (3) *Charas,* the resin which exudes from the leaves and branches—this is often adulterated: I have found thirty to fifty per cent. of mineral matter in specimens; and (4) *Majun,* a sweetmeat prepared with hemp. In India hemp appears to be seldom, or ever, used for homicidal purposes. Fatal, accidental or suicidal,

[1] About one-eighteenth of an inch in diameter, and weighing one hundred and twenty to the grain (Guy).

cases have, however, been reported. Cases also have been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. It is extensively used in India as an aphroditive, and with that object is a sweetmeat handed round at Nautches. Thus Chevers mentions a case which occurred at Ahmednagar, in which a

FIG. 59.—Indian Hemp. *Cannabis sativa.*

woman, having first drugged with *majun* a child aged seven, afterwards murdered him for the sake of his ornaments.[1] *Charas* is used by road-poisoners at Amritsar, in order to facilitate theft.[2] A case also is reported by Dr. Cullen, of Hoshangabad, in which *majun* was given to a woman and her daughter,

[1] *Med. Jur.*, p. 225.
[2] *Beng. Med. Leg. Rept.*, 1870–72, p. 268.

" not with the intention of causing death, but to effect a criminal purpose." In these two females the symptoms present exactly resembled those of datura poisoning, and it would appear that datura is sometimes used as an ingredient of *majun*.[1] In a case sent by the Bombay police in 1883, some food, alleged to contain cannabis, and to have been used for drugging persons in order to facilitate theft, was found to contain a resinous substance, which, when separated and given to a dog, caused distinct narcotic symptoms.

Symptoms.—Some persons exhibit great susceptibility to its action, fractional doses, even as medicine, producing alarming symptoms of floating up into the air.[2] Hemp acts on the brain, causing usually excitement, followed by narcotism. During the stage of excitement, the individual is the subject of hallucinations, usually, but not invariably, of the pleasurable, and often of a sexual character. In this stage the patient may show no outward indications of excitement, or he may be constantly laughing, singing, or talking, or furiously delirious. In animals, it shows itself by a swaying movement of head and body. This stage is followed by one of narcotism, usually with dilated pupils. Commonly, there is tingling and numbness of parts of, or over the whole body, or, in severe cases, general anæsthesia may be present.

Detection.—The active principle of cannabis is generally considered to be a resinoid body, *cannabin*. In addition it contains a volatile oil, and from recent researches, apparently, also a volatile alkaloid in minute quantity. Authorities differ on the question of the action of these two last-mentioned substances. Warden and Waddell[3] are of opinion, however, from the results of their experiments, that both the oil and a volatile, apparently alkaloidal, substance separable by distillation from an alcoholic extract of the plant, are inert. *Cannabis cannot be identified by chemical tests.* Its recognition, therefore, in a medico-legal inquiry must depend on the physical characters of the plant, and its physiological action.

(*a*) *Physical character.*—Dymock describes the leaves as deep green in colour; they " have long petioles and are digitate, with linear-lanceolate, sharply-serrated leaflets, tapering to a long smooth point." The same author also states, " The flowers form erect clustered spikes, often six to eight inches long;

[1] Ainslie speaks of datura as a usual constituent of *Majun*; Hoingberger says that it is sometimes used as an adulterant of *Majun*.

[2] *Cp.* Christison's *Dispensatory*.

[3] *Pharmaceut. Jour.*, 1885–86.

in the drug (*ganja*) the spikes are compressed, flat, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour.

According to Dr. S. N. Ridley, the following characters of Indian hemp are peculiar: (1) The leaves are small, narrow, and serrated. The serrations are pointed, and the leaves are covered with hairs, including the free margin. (2) When the hemp is fresh and in good condition, each hair is seen (when examined with a lens) to be terminated by a lump which may be of a golden colour. (3) The seeds are covered by a loose husk, the outer surface of which is marbled in a characteristic way. If young the seeds are of pale fawn colour with no marbling. In good ganja the seeds should be grey with white marbling, mixed with a certain amount of pale young seeds. If too old the appearance is similar, but there is a larger proportion of fully mature seeds. The leaves are in this case in bad condition and withered. In good ganja some of the buds are still compact and unopened. If fresh and in good condition ganja has a peculiar musty smell and taste.

(*b*) *Physiological action.*—Portions of the drug, if available, may be administered to a dog; or food, sweetmeat, etc., supposed to contain cannabis, may be digested with alcohol, the alcoholic solution filtered and concentrated. The resin may be then precipitated by the addition of water, separated, and administered to a dog.

Use of cannabis as an intoxicant.—This is widely prevalent in India, the drug being either smoked (*ganja* smoking) or swallowed. Insanity in India is often attributed to indulgence in cannabis (see p. 369). Chevers remarks that "it is a matter of popular notoriety, both in Bengal and the North-West Provinces, that persons intoxicated with *ganja* are liable to commit acts of homicidal violence. In some cases of homicide committed, or alleged to have been committed, while under the temporary influence of cannabis, one person only has been attacked. Usually, however, the victims are numerous, the case assuming the form known as *running amok* (see p. 657). Cases of running amok, however, have been reported in which the criminal has been under the influence of an intoxicant other than cannabis (see *Case*, p. 370), and also cases in which the criminal does not appear to have been under the influence of any intoxicant. In running amok cases, whether while under the influence of an intoxicant or not, usually the first individuals injured are persons with whom the criminal is at enmity. Commonly, when acts of homicidal violence are

committed while under the influence of an intoxicant, some motive is traceable for the crime. In some cases the motive will, on inquiry, be found to have pre-existed the intoxication; and when this is so, there often appears to be reason to suppose that the intoxicant is taken by the criminal with the object of nerving himself for the deed. In other cases, the motive, such as it is, apparently comes into existence subsequent to the commencement of the intoxication. As already pointed out, the question of criminal responsibility for acts done while in a state of intoxication, is not affected by the nature of the intoxicating agent. Hence *ss.* 85 and 86 of the *Indian Penal Code* apply with the same force to cannabis intoxication as they do to alcoholic intoxication. Indian hemp is sometimes administered with criminal intent in tobacco, a pipe or 'huka' of which is offered to the victim.

Cases.—**Homicidal violence committed while under the influence of cannabis** (Chevers, *Med. Jur.*, pp. 790 *et seq.*).—(*a*) "Madar Buksh, of Mirzapore, hacked his wife to pieces, inflicting twenty-two wounds with a sword, probably under the influence of jealousy. He confessed the crime, saying he suspected the woman of infidelity, and that before his return home on the fatal night a man gave him a pill to eat; it was majun, or bhang, and very powerful. The person named denied altogether that he had given the pill to the prisoner. The judge thought it not improbable that intoxication was resorted to purposely to gain heart for the deed which was meditated."—(*b*) "One Kumla, a burkundauze of Bulandshahr, killed, without any evidence of sufficient provocation, two boatmen who were ferrying him across the river. The Sessions Judge believed that having been at a religious festival at Belown, the prisoner had probably indulged in bhang, or some intoxicating liquor, and being temporarily excited, was irritated by the slowness of the men. He was sentenced to death."—(*c*) Three sepoys went over from Bhurtpur to witness the religious ceremonies at Gobardhan. Suddenly, and, as far as could be ascertained, without any provocation, one of them drew his sword, decapitated first one of his comrades, and then three women, entirely strangers to him. His defence was that he had taken bhang, and was beside himself. Before the magistrate he had said that the man whom he had killed had threatened to strike him. At the time he committed the act he apparently showed no signs of intoxication.

Cases.—**Running amok.**—(*a*) (Chevers, *Med. Jur.*, p. 792). A Mohammedan khalasie, excited by jealousy of his wife, apparently determined to revenge himself on mankind in general. He seized a sword, rushed into the street, and attacked every one he met. Before he could be secured he had killed two children, and wounded, more or less seriously, two other children and seven adults.—(*b*) (*ibid.*, p. 791). A havildar in the Kumaon battalion, while seated in the orderly room with other native officers of the regiment, suddenly rose and killed one Nardeb, an acting havildar, with a kukri. He then rushed about and wounded two sepoys of the corps. It was alleged that deceased had debauched the prisoner's wife.

Wormseed.—The unexpanded flower-heads of *Artemisia maritima* and other species N.O. *Compositæ Kirmani-owa* (Bom.), used in medicine as a vermifuge, contain 1½ to 2 per cent. of *santonin*, a crystalline principle to which their activity is due. Santonin is the anhydride of santonic acid, and is administered medicinally in doses of two to five grains. Large doses of wormseed or of santonin give rise to symptoms of irritant poisoning, accompanied by delirium or convulsions, followed by stupor. The pupils are dilated, and a peculiar disturbance of vision, owing to which everything appears at first bluish, and afterwards yellow or greenish-yellow, is a constant symptom. Taylor [1] quotes a case where 155 grains of wormseed proved fatal to a girl aged ten; and Chevers [2] mentions two cases, in each of which three grains of santonin caused serious symptoms in children. Treatment, general as for cerebral poisons. Detection.—From organic mixtures santonin may be extracted by a process similar to that employed for plumbagin, using chloroform instead of ether as a solvent. When dissolved in slightly diluted sulphuric acid, and the solution warmed, a red colour, passing into purple, and finally into brown, is produced by the addition of ferric chloride solution.

Wormwood.—The leaves and tops of *Artemisia absinthum*, N.O. *Compositæ*, and probably of other species of artemisia, contain a bitter principle (absinthin) and a volatile oil. The latter is a narcotic poison, causing stupor, convulsions, and dilated pupils. In one case half an ounce of the oil caused very severe symptoms in a male adult. *Absinthe*, a French liqueur, contains oil of wormwood, and when taken in excess gives rise to loss of intellect, paralysis, and epileptiform convulsions, combined with the usual effects of chronic alcoholic poisoning. **Tansy.**—*Tansy*, *Tanacetum vulgare*, N.O. *Compositæ*, contains a volatile oil possessing apparently a similar action on the system to oil of wormwood. Woodman and Tidy [3] mention two cases of poisoning by Tansy, taken with the object of causing abortion. In both cases coma supervened, but in neither was miscarriage produced. One of the two terminated fatally. **Coriaria myrtifolia.**—A few cases of poisoning by the berries and leaves of this plant—a native of Europe—have been reported, the symptoms being coma, convulsions, and dilated pupils. In one case an adult died in twenty-four hours from eating fifteen of the berries. In another an adult died in four hours from swallowing an infusion of senna leaves that had been adulterated with the leaves of this plant; [4] and Taylor [5] mentions a case where a whole family in France was poisoned by eating snails that had been fed on the leaves and young shoots. **Camphor.**—Common or officinal, or Laurel Camphor, *Kafar* (Hind.), *Karuppuram* (Tam.), *Kapur* (Bom.), *Kapur* (Beng.), is a volatile crystalline substance obtained from the *Cinnamomum camphora* or *Laurus camphora*, N.O. *Lauraceæ*. Its chemical composition is represented by the formula. Another variety, Borneo camphor, from the *Dryobalanops aromatica*, N.O. *Dipterocarpeæ*, has the composition. Camphor is administered medicinally in doses of one to ten grains. In large doses it acts as a poison, causing excitement and delirium, with dilated pupils and sometimes convulsions. Several cases of poisoning by camphor, nearly all of them non-fatal, are on record. In one case thirty grains caused furious delirium in an adult, and in another twenty grains, swallowed in solution by an adult, caused severe symptoms. Recovery has been reported from a dose of 160 grains, and in another case from a dose of 270 grains.

[1] Taylor, *Poisons*, p. 682. [2] *Med. Jur.*, p. 283.
[3] *For. Med.*, p. 451. [4] Woodman and Tidy, *For. Med.*, p. 293.
[5] *Poisons*, p. 169.

Poisonous Mushrooms.

Certain species of mushrooms are non-poisonous and are used as articles of food. Others are poisonous, and cases of accidental poisoning occasionally occur from one of the poisonous being mistaken for an edible variety. Poisonous mushrooms have the following characters:—Unlike non-poisonous mushrooms they have a bitter, astringent, acrid, or salt taste, and on section and exposure change colour, a brown, green or blue tint developing on the cut surface. The symptoms in mushroom poisoning may be those of irritant poisoning, or those of cerebral poisoning, or both sets of symptoms may be present. Prominent cerebral symptoms in mushroom poisoning are excitement and intoxication, convulsions, delirium, and stupor, with dilated, or in some cases contracted, pupils. Of the better known poisonous varieties, one, the *Amanita muscaria*, or fly-blown agaric, appears to owe its activity partly to an undiscovered substance destroyed at the temperature of boiling water, and partly to an alkaloid called *muscarine*. Muscarine taken internally causes contraction of the pupils;[1] hence this condition is present in cases of poisoning by *Amanita muscaria*.[2] Atropine appears to be to a great extent antagonistic in its action to muscarine, and is recommended as an antidote. A curious fact about poisoning by *Amanita muscaria* is that it renders the urine intoxicating; and in Kamschatka, where this fungus is used as an intoxicant, individuals are in the habit of drinking their urine so as to renew the intoxicant effect. Cases of poisoning have also been reported in Europe from the common *morelle*. The poison of this variety appears to be soluble in boiling water, and volatile, and to disappear when the morelles are cooked or dried. Poisonous mushrooms are to be met with in India. Chevers mentions a case of mushroom poisoning which occurred at Jessore in 1853. **Treatment.**—Emetics followed by stimulants, warmth to the surface, and hypodermic injection of atropine in one-fiftieth grain doses.

Poisonous Food-grains.

Various cereals affected with ergot and diseased maize (pellagra) become poisonous, as has been already mentioned. Cases of poisoning also have arisen through the eating of

[1] Lauder Brunton's *Pharmacology*, p. 187.
[2] Woodman and Tidy, p. 306.

certain poor grains and jungle-peas, especially in times of famine, resulting in spastic spinal paraplegic affections with polyneuritis, which have been broadly classed as Lathyrism or 'Bean paralysis' in Europe, so called after the particular genus of peas or vetches most commonly causing these symptoms, though similar disturbances result from eating certain grasses and other plants. Cases of this kind of poisoning are most common in the Central Provinces, including Chota Nagpur and in the outer Himalayas. When mixed with three-fourths of wheat, and cooked as pottage or bread, it is apparently harmless, but cooked entirely itself it acts as a poison.[1] The poisoning may be in epidemic form.

Lathyrism.—The continued consumption of *Lathyrus sativa* (*Kessari dhal* or *Teori*) and other species of vetch such as *L. cicera*, has given rise in Italy, Algiers, Abyssinia, as well as in Sind, Chota Nagpur, the Central Provinces and elsewhere in India, to epidemics of spastic paraplegia.

The onset is in many cases sudden. The patient may wake up feeling pains in the loins and calves and an inability to move his legs. The lower limbs assume the rigid character of spastic paraplegia (*lateral sclerosis*) and in severe cases may proceed to complete paraplegia. The knee-jerk is greatly exaggerated; ankle-closius is generally readily obtained and in severe cases is caused in progression when the weight of the body is brought to bear on the ball of the toes. A slight tap may throw the legs into severe clonic spasm. Initial and transitory paralysis of the bladder has been described, but was not noticed in any cases.

Beyond the initial backache, etc., there is no sensory disturbance, there is no muscular atrophy except such as arises under the famine conditions which may have forced the patient to resort to a diet of *pessari*.

The head, upper part of the trunk and upper extremities are not affected, so that late in the disease when the rigid legs are useless for progression, the patient drags or pulls himself along by means of a *lathi* grasped in the hands, or in other cases squats in a metal basin and "rows" himself about with clogs held in the hands.

Lolium temulentum, *Darnel* or *Bearded Darnel*, *Mostaki* (Panj.), *Mochni* (N.-W.P.).—A few cases of poisoning, mostly non-fatal, have occurred both in India and in Europe, due to the consumption of bread, etc., made from grain containing darnel seeds. The symptoms of darnel

[1] For an old account of its wide prevalence, see Colonel Sleeman's *Rambles*. Dr. Irving (vide *infra*) reported in 1857 that in one district of Allahabad division 6 per cent. of the population were affected.

poisoning are chiefly giddiness, with tremors of the muscles and dilated pupils, followed by stupor. Irritant symptoms may also be present. Christison mentions three European cases of mass poisoning by Darnel affecting respectively eighty, seventy-four, and forty persons, all of whom seem to have recovered. Similar cases have been reported as occurring at hill stations in the Panjab and N.-W. Provinces. The precise nature of the poisonous principle of darnel is unknown. **Identification.**—According to Hassall, the starch granules of darnel are polygonal, like those of rice, but much smaller. The structure of the testa, also, in the main resembles that of rice, differing, however, in the fact that in darnel the outer coat consists of a single layer of broad cells disposed transversely, and not of narrow transverse fibres as in rice.

Paspalam scrobiculatum, *Kodra* or *Harik*.[1]—Cases of poisoning are occasionally met with in India arising from the consumption of this grain as an article of food. The symptoms of Kodra poisoning are very similar to those of poisoning by darnel, namely, tremors and twitchings of the muscles, giddiness, and seeming intoxication, with impaired vision followed by sopor, and accompanied in some cases by irritant symptoms. Kodra poisoning occasionally ends fatally: thus in a case reported to the *Bombay Chemical Analyser*, from Godhra, in 1879–80, four persons, viz. a man and three children, were poisoned by eating bread made from kodra flour, and one of the children died. *Kodra* appears to be only occasionally poisonous; according to popular belief, in fact, it is supposed that there are two varieties of the grain, a sweet and bitter variety (*Goraharik* and *Majara harik* or *Mena Kodra*), of which the latter alone is poisonous. As is the case with Darnel, the precise nature of the poisonous principle present in kodra is unknown. So like, however, are the symptoms of kodra to those of darnel poisoning, that it has been suggested that so-called *Kodra* poisoning is really *Darnel* poisoning, arising from accidental mixture of Darnel with the grain. Six cases of such poisoning by Kodra bread are reported in the *Ind. Med. Gaz.* of 1919, p. 379.

Maize poisoning.—This condition, which has been called 'Zeism,' produced by defective maize, appears to be *Pellagra*.

Certain of the poisons already described under Vegetable Irritants act also on the brain. Thus stupor or insensibility with dilated pupils has been observed in poisoning by *Tylophora fasciculata*, *Daphne mezereum*, Laburnum, and Yew. Cerebral symptoms also present in cases of poisoning by *Cocculus indicus* and the fruit of *Terminalia bellerica*. Lastly, it may be mentioned that cases have been met with in India (chiefly among children) which tend to show that the kernels of the fully developed seeds of star-anise, *Illicium anisæum*, possess a narcotic action.

[1] Dr. G. Watt, *Ind. Med. Gaz.*, 1895.

CHAPTER XXIX.

SPINAL POISONS.

UNDER this head may be grouped a few of the neurotic poisons which act mainly on the spinal cord. This action may be stimulant in character or the reverse. If stimulants, the result may be production of muscular spasm as in strychnine poisoning; if the reverse, paralysis, or loss of sensation, results. Cerebral symptoms are, as a rule, either absent or slight, and death usually occurs by asphyxia, due to arrest of the movements of respiration. This arrest may, as in strychnine poisoning, be the result of spasm, but is more commonly due to paralysis, though calabar bean slows the action of the heart, and so may cause death by syncope.

General indications of Treatment should be: (1) Elimination, by giving emetics or using the stomach-pump; (2) prevention of action by administration of animal charcoal, or of gallic acid, or tannin or decoctions containing tannin; (3) counteraction of effects by treatment of the symptoms as they arise, *e.g.* administration of stimulants to counteract depression, employment of artificial respiration, etc. Certain drugs more or less antagonize the action of some of the poisons of this order, and are recommended for use as physiological antidotes; thus, in strychnia poisoning, inhalation of chloroform is specially indicated.

Spinal poisons may conveniently be divided into (1) those which specially affect the cord, or central poisons, and (2) those which primarily affect the peripheral extremities or trunks of the nerves, or peripheral poisons. The central spinal poisons include strychnine, calabar bean, and gelsemium; of these the first excites, and the other two paralyze, the cord.

Nux Vomica and Strychnine.

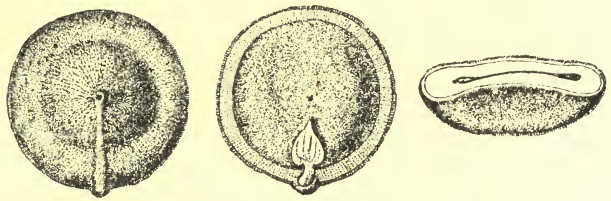
Strychnine or strychnia is one of the most deadly of known poisons. It is contained in several plants common in India

belonging to the genus *Strychnos* of the N.O. *Loganiaceæ*, together with another poisonous alkaloid of similar action, but milder in degree, named **brucine.**

These two alkaloids are contained in *nux vomica*, in combination with strychnic or igasuric acid, probably identical with malic acid. Strychnine and brucia have been found present in :—

1. Strychnos Nux Vomica, *Kuchila* (Hind.), *Kajra* (Bom.), *Ettikkottai* (Tam.). The seeds of this, disc-shaped, are officinal, and the bark is met with in commerce under the name of "false angostura bark." All parts of the plant are bitter and poisonous. 2. Strychnos Ignatii, *Papita* (Hind. and Bom.), *Kayappankottai* (Tam.). The seeds of this are known as *Faba amara* and St. Ignatius' beans. 3. Strychnos colubrina, *Snakewood*, *Naga-musadi* (Tel.), *Modira-caniram* (Mal.), *Kuchila-lata* (Hind.), *Goagari-lakri* (Bom.), *Kajarwel* (Mar.). 4. Strychnos Tieute, the Upas tree of Java and a noted arrow poison.

Strychnos toxifera belonging to the same genus is believed to be the chief source of curari (which see, p. 712). Several species of strychnos



a. *b.* *c.*

FIG. 60.—Nux Vomica, $\frac{3}{4}$ths natural size.

a. Surface with raphe.
b. Longitudinal section showing albumin and embryo.
c. $\frac{1}{2}$Transverse section showing central cavity.

are non-poisonous : of these the most important is the Strychnos potatorum, *Nirmali* (Hind.), *Tetrankottai* (Tam.), *Nivali* (Mar.), the seeds of which are used under the name of clearing nuts, for clearing muddy water. They are subglobose, half or less the diameter of nux vomica, brownish-grey in colour, and not bitter.

In India, poisoning by nux vomica is occasionally met with, the cases being generally suicidal or accidental.

Among the causes leading to accidental poisoning may be mentioned, (*a*) The practice of nux vomica eating, which to a certain extent prevails in some parts of India ; and (*b*) The substitution of nux vomica or *kuchila* bark for other barks, notably for *kurchi* or *holarrhena antidysenterica* bark, a drug in common medicinal use in India as a tonic and antiperiodic for children, and as an astringent in dysentery. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of holarrhena bark being seized, about one-fourth of it was found to consist of nux vomica bark. Waddell suggests that

this substitution may partly account for the great mortality among infants and children, yearly reported from tetanus in Calcutta.[1]

Poisoning by the alkaloid Strychnine, formerly rare in India, has of late years become more frequent, owing to the greater ease with which the alkaloid can be obtained. It is usually accidental in the Bombay Presidency; strychnine powders have of late years been largely supplied to the police for the purpose of destroying dogs; and several cases of poisoning of human beings by strychnine have been reported, in which the poison was obtained from this source. Accidental poisoning has occurred through prescribing Liquor Strychnine along with its incompatible Liquor Arsenicalis, when the alkaloid is thrown down forming a poisonous dose at the bottom of the bottle. It may also occur from the deposit in the last few doses in bottles of Easton's Syrup.

Action, symptoms, etc. — Strychnine acts as a direct stimulant to the spinal cord, causing tetanic spasms, and death either from asphyxia, due to spasm of the muscles of respiration, or from collapse, occurring in the interval between the spasms. When swallowed (except when taken in the form of a pill) the first thing noticed is an intense bitter taste and dryness of tongue; this is frequently but not invariably succeeded by a feeling of suffocation and want of air. Twitchings and cramps follow, rapidly developing into intensely painful tetanic spasms, affecting nearly all the muscles of the body. During the spasms, the body frequently becomes rigid, and arched so as to rest only on the head and the heels (*opisthotonos*). During the fits of spasm also, the pupils are usually dilated, and the features drawn into a grin (*risus sardonicus*). The fits of tetanic spasm alternate with intervals of muscular relaxation, the relaxation being, as a rule, complete. As the case progresses towards a fatal termination, the intervals between the spasms become shorter and shorter in duration. The convulsions may be so severe as to stimulate bruises, see *Case* (*d*), below. There is no narcotism, but insensibility from exhaustion may occur before death.

Case (*a*).—**Strychnine poisoning, homicidal.—Neill Cream** tragedy.—In October, 1892, Neill Cream was convicted of the murder in London of Matilda Clover, and there was good evidence that he also murdered Marsh, Shrivell, and another young prostitute, and attempted the life of another to whom he gave on the street some pills to take, but she threw them away. The criminal had tea with Marsh and Shrivell on the night of April 11th, 1892, and gave them both "three long pills." Half an hour after

[1] *Ind. Med. Gaz.*, March, 1885.

Cream left them they were found to be dying, and died within six hours. From Marsh's stomach seven grains, and from Shrivell's nearly two grains of strychnine were separated, so that each pill probably contained at least three grains of strychnine. The body of Clover, exhumed six months after death, contained the same poison.

Case (*b*).—**Strychnine poisoning, homicidal.—Palmer** case.—Wm. Palmer, aged 31, a surgeon, in Staffordshire, England, was charged in 1856 with the murder of John Cook. Palmer, who was deeply in debt through racing matters, was under suspicion of having poisoned both his wife and brother in 1854 and 1855, their lives having been heavily insured by him. He was also heavily in debt to Cook, who was under his treatment for a sore throat. Cook was attacked by vomiting and burning pain in stomach immediately after drinking coffee handed him by Palmer, and some of the soup given by Palmer was sipped by the chamber maid, who also was seized with vomiting. A few days afterwards, on the 19th, Palmer purchased three grains of strychnine, and gave Cook two pills at night, and next day he purchased more strychnine, and gave two more pills, after taking which Cook was seized with tetanic convulsions and died. At the *post mortem* examination Palmer pushed against the surgeon who was placing the stomach in a jar, and upset the contents; he also tried to make away with the jar and its contents, and tried to bribe the driver to upset the carriage in which the jar was to be conveyed to the railway. Although no poison was found in the stomach, the circumstantial evidence was so strong that he was convicted and hanged.

Fatal period, etc.—In poisoning by strychnine, the symptoms usually appear in five to twenty minutes; in poisoning by nux vomica the appearance of the symptoms is less rapid, and in one fatal case their appearance was delayed for two hours.[1] Death may occur in ten minutes or be delayed for five or six hours. Of thirty-five cases collected by Woodman and Tidy,[2] nineteen died in an hour or less, and eleven more in one to three and a half hours.

Diagnosis from disease.—The chief points of distinction between strychnine poisoning and tetanus, the only disease likely to be mistaken for it (though epilepsy might be confused with it also), are:

(1) In poisoning the symptoms come on suddenly, rapidly become severe, and soon end in either death or recovery; in tetanus, as a rule, the reverse is the case. Chevers, however, mentions an exceptional case of sudden accession of tetanus, and death in the first spasm (see *Case* below). (2) In tetanus, the muscles of the lower jaw are early affected, stiffness of the lower jaw being often the first prominent symptom; in poisoning, the muscles of the lower jaw are the last to be affected. (3) In poisoning, as a rule, the muscles during the intervals are completely relaxed: this is not so in tetanus. The possibility of mistaking the injuries contracted during the violent spasms for homicidal bruises should be considered.

[1] Taylor's *Manual*, p. 172.

[2] *For. Med.*, p. 330.

Case.—**Sudden death in first spasm of Tetanus (or Epilepsy).**—Chevers, under this heading, cites the following case: "An apparently healthy boy, one of the pupils of the La Martinière School, Calcutta, was seated on his bed, having a small sore on his foot dressed by the native doctor. Having applied the dressing, the native doctor was leaving. He walked straight to the door, but as he was passing out he heard a noise from the bed. Turning, he saw the boy supported on his occiput and heels, his body being arched up in opisthotonic spasm. He ran to the bed, the body sank, and death was immediate."—*Med. Jur.*, p. 248.

Treatment.—Administer emetics or use the stomach-pump, chloroforming the patient so as to allow of the introduction of the tube. Give animal charcoal or infusions containing tannin. Administer chloral, or still better, keep the patient under the influence of chloroform.

Post mortem signs.—Not characteristic; as a rule, the body is relaxed at death; sometimes, however, it remains rigid, the rigidity continuing for a very long period. The brain, spinal cord, and lungs are usually found congested; the heart may be empty or full. The convulsions may have been so severe as to bruise the body.

Fatal dose, &c.—(*a*) Of Strychnine. A medicinal dose of this is one-thirtieth to one-twentieth of a grain. Taylor[1] estimates the fatal dose for an adult at half a grain to two grains. Some persons appear to be specially sensitive to the action of strychnine, and two cases are on record in which respectively one-twelfth and one-sixth of a grain caused alarming symptoms. In both these cases the subjects were adult females. The smallest quantities which have caused death are one-sixteenth of a grain in a child two to three years old, and half a grain of the sulphate in an adult.[2] Recovery has been recorded from doses of ten to twenty, and even forty grains of the alkaloid.[3] (*b*) Nux vomica.—Nux vomica seeds contain about a quarter to half per cent. of strychnine, and St. Ignatius' beans about one and a half per cent.[4] The medicinal dose of powdered nux vomica seeds is two to three grains. In one case thirty grains of powdered nux vomica seeds (equal to about one full-sized seed), taken in two doses of fifteen grains each, caused the death of a girl aged ten; and in each of two cases death was caused by fifty grains.[5] It should be noted that, owing to the insolubility of the testa, whole nux vomica seeds may be swallowed, and pass through the body, without giving rise to symptoms of poisoning.

[1] *Poisons*, p. 713. [2] Case of Dr. Warner, *ib.*, p. 712.
[3] Woodman and Tidy, *For. Med.*, p. 330.
[4] *Pharmacographia*, pp. 430, 433. [5] Taylor, *Poisons*, p. 695.

Influence of habit.—Many authorities state that in different parts of India nux vomica is habitually eaten (like arsenic) as a stimulant and aphrodisiac. Baker, quoted by Chevers,[1] states that those who practise this habit, begin with one-eighth of a grain of the seed, gradually increasing the dose to about twenty grains. If this is so, the inference of course is, that habit tends to confer on the system a resisting power to the action of strychnine. It is, however, undoubtedly the case that small doses of strychnine repeated at short intervals tend to exert a cumulative effect. Lauder Brunton, in fact, states that strychnine is a cumulative poison, and points out that this effect is due to the slowness with which it is excreted, one effect produced by it being to contract the renal vessels, and thus interfere with its own elimination.

Unusual cases.—Harley[2] records a case where an infant at the breast suffered from symptoms of strychnine poisoning, the result of the medicinal administration of strychnine to the mother, who remained unaffected. Dr. Chatterjee[3] met with a non-fatal case, resulting from the introduction, by a quack, of a pulp made from nux vomica seeds into a wound. Blyth[4] mentions a case of attempted suicide by a young woman, who took about one and a half grains of strychnine, and two ounces of laudanum. Severe symptoms of narcotic poisoning followed, but no symptoms of strychnine poisoning showed themselves until eight hours afterwards.

Preparations : (1) Officinal.—The following preparations of nux vomica are contained in the I.P. :—

	Strength.	Medicinal dose.
Infusion ..	1 to 48	½ oz to 1 oz.
Tincture ..	2 ozs. to 1 pint	5 to 20 drops.
Extract ..	1½ oz. equals about 1 lb. of the seeds	¼ of a grain to 2 grains.

The I.P. also contains a solution of strychnine; strength four grains to one ounce, or about 1 to 109. (2) Non-officinal.—Various vermin-killers sold in England contain strychnine. Blyth mentions the following :—Miller's rat powder, a mixture of one ounce of nux vomica to one pound of oatmeal; Battle's vermin-killer, a mixture of strychnine with flour and Prussian blue, containing about 7·7 per cent. of strychnine; and Butler's vermin-killer, a mixture of strychnine with flour and soot, or

[1] *Med. Jur.*, p. 241 [2] Woodman and Tidy, *For. Med.*, p. 330.
[3] *Ind. Med. Gaz.*, 1872, p. 251. [4] *Poisons*, p. 313.

sometimes Prussian blue, containing from about $3\frac{1}{3}$ to 5 per cent. of strychnine.

Identification.—Nux vomica seeds (see Fig. 60) are contained in a smooth orange-coloured berry about 2 inches in diameter, and containing about five seeds or 'nuts.' The seeds are in shape nearly circular discs, slightly concave on one side, and convex on the other, about one inch in diameter, by about a quarter of an inch thick. In colour they are light greyish, and have on the surface a silky appearance, due to their being thickly covered with short hairs. In the centre of the concave side is the *hilum* connected by a slightly elevated *raphe* with the *chalaza*, which forms a small protuberance on the edge in the neighbourhood of the radicle (see Fig. 60). They are very tough and horny, and have an intensely bitter taste. St. Ignatius' beans are about one and one-fifth of an inch in length, ovoid, but presenting three to five flattened surfaces due to mutual pressure. "In the fresh state they are covered with silvery addressed hairs; portions of a shaggy brown epidermis are here and there perceptible on those found in commerce, but in the majority the seeds show the dull grey granular surface of the albumen itself."[1] Nux vomica bark occurs in quilled twisted pieces, an inch or less in diameter, thin, light brown in colour, and marked on the outer surface by numerous small light-coloured elliptic corky warts. Its inner surface is turned red by citric acid,[2] this distinguishes it both from angostura or cuspara bark, and from holarrhena antidysenteria bark; the latter also is much thicker, and is marked on the external surface by scars of exfoliation.

Detection.—Strychnine occurs in commerce as a white powder, or in white rectangular prismatic crystals, but may be obtained in other crystalline forms, *e.g.* hexagonal prisms, octahedra, or forms derived from the octahedron. It is freely soluble in chloroform (1 to 7 or 8), less soluble in alcohol (about 1 to 100), and still less soluble in ether. It is only very sparingly soluble in pure water (about 1 to 7000 of cold water), but readily dissolves in dilute acids. Its solution in faintly acidulated water has an intensely bitter taste, and is precipitated by the alkaloidal group reagents. It sublimes at 169° F., and condenses in minute needles. The special tests for strychnine are:

1. **Bitter taste.** 2. The colour test.—This depends on the fact that a play of colours, namely, blue, rapidly changing to

[1] *Pharmacographia*, p. 388.
[2] Owing to the presence of brucine (see p. 659).

violet, and then slowly to purple, and lastly, to red, is produced when strychnine is subjected to the action of nascent oxygen. To apply the test, stir a minute quantity of strychnine with a drop or two of strong sulphuric acid; the strychnine dissolves if pure without change of colour. Then cautiously add a minute quantity of manganese dioxide, or lead dioxide, when the play of colours appears. Potassium permanganate, or potassium dichromate, may be used instead of manganese or lead dioxide, but are not so suitable; or the test as proposed by Letheby may be conducted galvanically. In this modification, the strychnine, dissolved in a drop or two of strong sulphuric acid, is placed on a piece of platinum foil connected with the positive pole of a galvanic battery; on touching the liquid with

FIG. 61.—Strychnine crystals × 120.
Obtained from an alcoholic solution.

FIG. 62.—Strychnine + potash or ammonia × 30.

the negative pole, the play of colours appears. It has been objected that various substances, *e.g.* pyroxanthin, piperine, salicine, bile, etc., become coloured when treated with strong sulphuric acid. With these substances, however, the colour appears directly the acid is added, while with strychnine no colour appears until after the addition of the manganese dioxide, or other oxygen-yielding substance. Aniline salts, Woodman and Tidy point out, are not coloured by sulphuric acid only, but give a play of colours when manganese or lead dioxide is added; with aniline salts, however, the colours are first "green, then a very persistent blue, then black." 3. The physiological test.—This consists in administering, preferably by subcutaneous injection, a little of the suspected alkaloid to a small animal, *e.g.* a frog, and observing whether or no tetanic symptoms are produced. Substances other than strychnine induce tetanic symptoms; the physiological test is only useful as a negative test, to prove the absence of strychnine, or as a confirmatory test. If, however, definite chemical

evidence of the presence of strychnine has been obtained, the physiological test is quite unnecessary.[1]

Brucine.—This alkaloid also has an intensely bitter taste. Its physiological action is the same as that of strychnine, but seven to ten times weaker. It is less soluble in ether, but more soluble in water, alcohol, and chloroform, than strychnine. Unlike strychnine, it gives no play of colours with nascent oxygen. The special colour test for brucine, a test to which strychnine does not respond, is as follows: Add a little strong nitric acid; a bright red colour is produced, which, on warming, becomes yellow. If, after warming, a trace of stannous chloride be added, the yellow changes to purple, destroyed by excess of stannous chloride or of nitric acid.

From organic mixtures, strychnine and brucine may be separated by Stas' process, using chloroform, or a mixture of ether and chloroform, as a solvent. If both are present, the alkaloidal residue will respond both to the nitric acid test and the nascent oxygen test. The discovery of both, in a case of poisoning, indicates that probably portions of a plant containing the alkaloids, *e.g.* nux vomica, have been employed.

Failure to detect strychnine.—Strychnine is an extremely stable substance, not likely to be destroyed by putrefaction. Richter[2] found it in putrid tissues after eleven years' exposure to decomposition in open vessels. Elimination also of strychnine from the body is comparatively slow. Hence, given that the analysis has been properly conducted, and that a sufficient quantity of material has been submitted to analysis, failure to detect strychnine in the body is strong evidence against death from strychnine poisoning. It is not, however, absolutely conclusive evidence against this supposition, as it is just possible that if death has occurred from a minimum dose of strychnine, and the patient has lived for some time after its administration, complete elimination of the poison may take place before death.

Stimulation of the spinal cord is caused also by Thebaia, one of the opium alkaloids; this, however, is less active even than brucia. It is also caused, according to Lauder Brunton, by Calabarine, one of the alkaloids of Calabar bean. Spasms, more or less tetanic in character, pointing to a stimulant action of the cord, have been observed in poisoning by Nerium odorum. Stimulation of the spinal cord resulting in the production of epileptiform convulsions, is one of the effects of Picrotoxin, the active principle of *Cocculus indicus;* and Blyth mentions as

[1] Blyth, *Poisons*, p. 323. [2] *Ibid.*, p. 321.

similar in its action to picrotoxin, the poison of *Illicium religiosum*, a plant growing in Japan. Venous blood, it may be here noted, irritates the nerve-centres; hence in narcotic poisoning, and poisoning by drugs tending to cause death by asphyxia, convulsions may precede death, even when the poison itself has no irritant action on the nerve-centres.

Calabar bean.—The seeds of *Physostigma venosum*, N.O. *Leguminosæ*, a native of Western Africa, *Physostigmatis semina*, *Calabar beans*, are highly poisonous. A dose of twelve grains of the seeds taken for purposes of experiment, caused alarming symptoms in an adult. In 1864, a number of children were accidently poisoned at Liverpool by eating the beans; one who had eaten six beans died; and two who had eaten the broken fragments of the kernel of one bean, suffered severely, but recovered. Calabar bean **paralyzes the spinal cord,** slows the action of the heart, and causes death by paralysis of respiration. In experiments on animals, large doses have been found to at once arrest the heart's action, and cause death by syncope. In poisoning by Calabar bean, the prominent symptoms are gastric irritation, slight tremors followed by great weakness of the muscles, and slowness of the pulse and of respiration. The mental faculties are unaffected. The pupils are contracted, but the poison appears to act more powerfully on the pupils when locally applied than when swallowed. Three alkaloids are described as present in Calabar bean, viz. physostigmine, eserine, and calabarine. Of these, the first two are considered by many to be identical with one another, and are apparently the constituents to which the paralyzing action of the poison is due. Calabarine, according to Lauder Brunton, causes convulsions like strychnine. **Treatment.**—General, as for spinal poisons (p. 651). Both atropia and chloral, to a certain extent, antagonize the action of Calabar bean, and have been recommended as physiological antidotes. The antagonism is in neither case complete, but appears to be greater in extent with chloral than with atropia. **Identification.**—The beans are kidney-shaped, chocolate coloured externally; and have a broad black furrow, with raised edges lighter in colour than the rest of the surface, running along the convex border. Dimensions about 1 to $1\frac{1}{4}$ by $\frac{3}{4}$ by $\frac{1}{2}$ an inch; weight about sixty-seven grains. Physostigmine may be extracted from organic mixtures by Stas' process, using benzene as the solvent, and identified by its action on the pupil, and by the red colour given by its sulphate with bromine water.

Gelsemium.—*Gelsemium nitidum* (syn. *G. sempervirens*), or yellow jasmine, N.O. *Loganiaceæ*. The dried rhizome and rootlets of this,

officinal B.P. (1885), are used in medicine.[1] In overdoses, the drug paralyzes the cord, and causes death by paralysis of respiration. Unlike Calabar bean, gelsemium has no very marked action on the heart.

Its active properties appear to be due to the alkaloid *gelsemine*. Wormley estimates that not more than one-sixth of a grain of gelsemine was contained in a dose of the drug which proved fatal to an adult female. Five fatal cases of poisoning by gelsemine have been reported.[2] The prominent symptoms are muscular weakness, followed by giddiness, frontal headache, double vision, and squinting. The weakness deepens into paralysis, the eyelids drop, vision becomes indistinct, and the muscular power of speech is lost. Respiration becomes slow, and the surface cold. The mind remains unaffected. The pupil is usually contracted, but Ringer points out that gelsemine, when locally applied, causes dilatation of the pupil, or a reverse effect to that produced by internal administration of the drug. **Detection.**—Gelsemine may be extracted from organic mixtures by Stas' process, using chloroform as the solvent. The colour tests for it are: (1) with sulphuric acid and manganese dioxide it gives a damask-red colour, changing to a rich green, most marked at the edges; and (2) nitric acid strikes with it a brownish-green, quickly changing to deep green.

Paralysis of the cord is also the special action of methyl-conia, a liquid volatile alkaloid allied to conia (see 'Conium'); and *ulexine*, a powerfully poisonous alkaloid contained in Gorse (*Ulex europœa*), is said to paralyze the motor tract of the cord, and the trunks of the motor nerves.

[1] According to the B.P. (1885), the medicinal dose of the dried root is five to thirty grains, and of the tincture—strength one to eight—five to twenty minims.

[2] Wharton and Stille (1884), Vol. III., p. 416.

CHAPTER XXX.

CEREBRO-SPINAL POISONS, CARDIAC, ETC.

Cardiac Poisons.

Of the poisons which act more or less directly on the heart, through a direct action on its nerve-supply, Tobacco and Lobelia are spinal as well as cardiac poisons, and cause death by asphyxia due to paralysis of the respiration, whilst Digitalis and Oleander appear to act directly on the cardiac muscle, thus tending to arrest the heart's action and cause death by syncope. Like spinal poisons, cardiac poisons leave no characteristic *post mortem* appearances.

General treatment indicated in cardiac poisoning is to try to secure: (1) Elimination, by emetics or the stomach-pump; (2) Prevention of Action, by giving decoctions containing tannin; (3) Counteraction of Effects, by the administration of stimulants, and the employment of physiological antidotal measures, such as keeping the patient in a recumbent position, keeping the surface warm, employing galvanism, and, if required, artificial respiration.

Tobacco.

Nicotiana tabacum, Tobacco, N.O. *Solanaceæ*; '*Tambaku*' (Hind., Beng., and Bom.), *Pugaiilai* (Tam.).—The dried leaves of this plant are officinal B.P. and I.P., and form the ordinary tobacco used for smoking, etc. They contain a poisonous liquid volatile alkaloid, *nicotia* or *nicotine*, and also an unimportant volatile crystalline substance, nicotianin, or tobacco camphor. Cases of poisoning by nicotine are rare; one celebrated case is, however, on record, namely, the case of Count Bocarmé, convicted of poisoning his wife's brother, by forcible administration of nicotine. Cases of poisoning by tobacco, mostly accidental, are more common. Death has resulted from swallowing tobacco, from administration of a decoction of tobacco as an enema, and from swallowing tobacco juice such as collects in

pipes; and bad symptoms have been caused by the application of tobacco leaves to a wound, and even to the sound skin. Death has occurred from excessive smoking; it is doubtful, however, whether tobacco smoke contains nicotine; probably its poisonous effects are due to pyridene bases, developed during the combustion of the tobacco.

Action, symptoms, etc.—Tobacco first slows and afterwards quickens the pulse, acting on the heart through the vagus, which it first stimulates, and afterwards paralyzes. It is also a spinal poison, and causes death by paralyzing the respiration. The prominent symptoms of tobacco-poisoning are giddiness, muscular weakness, faintness, and depression, abdominal pain, vomiting, sometimes purging, difficult respiration, and convulsions. The pulse is at first slowed, afterwards it becomes quick, weak, and irregular. Death usually occurs rapidly. In one case fatal results followed the administration, as an enema, of a decoction of half a drachm of the leaves. **Treatment.**—Evacuate the contents of the stomach, give tannic acid and stimulants, keep the patient in a recumbent posture, and apply warmth to the surface. Blyth recommends cautious hypodermic injection of strychnia. *Post mortem* signs.—Not characteristic; there may be congestion of the brain, lungs, and liver. In some cases inflammation of the stomach and intestines has been found. **Detection.**—Portions of tobacco leaf may be found and recognized by their odour and physical characters. Nicotine may be extracted from organic mixtures by Stas' process as for conium, and recognized by its odour and action on animals. There are no special colour tests for nicotine. Nicotine does not coagulate albumen, and gives a crystalline precipitate with mercuric chloride solution (a distinction from conia).

Lobelia Indian.—*Lobelia nicotianæfolia*, vern. *Deonal*, *Bokenal*, *Dhaval.*—This lobelia, Dymock states, is found upon the mountain ranges of Ceylon and Southern and Western India. The upper portion of the stem is hollow, and is dried and used as a shepherd's pipe. The plant has recently been examined, and found to contain the same active constituents as *L. inflata*. Dymock gives the following description of the plant: "The leaves resemble those of the tobacco; they are finely serrated and covered with simple hairs. The lower part of the stem is woody, an inch and a half or more in diameter, and almost solid; the upper portion is a hollow tube ending in a crowded head of flower spikes; the latter are about a foot in length, and when the plant is in fruit, are thickly set with globular capsules about the size of a pea, to which a portion of the dry flower is often adherent; the capsules are two-celled, each cell containing a fleshy placenta. The seeds are numerous and very small (one-fiftieth of an inch in length), oval, flattened, and marked with delicate lines. Several small tubercles surround the site of the placental attachment; their colour is light brown. The whole plant when dry is

studded with small spots of resinous exudation, and is hot and acrid to the taste." **Action,** symptoms, etc.—Similar to those of poisoning by tobacco, except that there is more burning pain in the stomach, etc. As in poisoning by tobacco, death occurs by paralysis of the respiration. Ten to fifteen grains of the powdered leaves or seeds will act as a strong emetic, and a drachm of the powdered leaves has caused death. **Treatment** should be the same as in poisoning by tobacco. *Post mortem* signs.—Inflammation of the stomach and intestines, and congestion of the vessels of the brain.

Digitalis.

Purple Foxglove, or *Digitalis purpurea*, N.O. *Scrophulariaceæ* (see Fig. 63). This plant, although a native of Europe, is grown in India,

Fig. 63.—Digitalis purpurea.

where its active principle is found to be of equal strength to that contained in European specimens (Hooper, *I.M.G.*, 1913, 481); all parts of it are poisonous. The leaves, probably the most poisonous portion of the plant, are officinal B.P. and I.P. Several active principles have been described as present in digitalis, of which the most important are

digitoxin, *digitalin* (a glucoside) and *digitalein*.[1] Of these, the last is the only one soluble to any extent in water. All three are powerful heart poisons. They stimulate the cardiac muscle and prolong the contractions of the heart, subsequently rendering the heart's action irregular, and finally arresting it. Of the three, digitoxin is said to be five to ten times more powerful than either of the others. Blyth estimates that one-sixteenth of a grain of digitoxin would probably prove fatal to an adult. When boiled with dilute acids, digitoxin yields toxiresin and digitalin yields digitaliresin; both these are also highly poisonous, but cause convulsions like picrotoxin.

Commercial digitaline.—Formerly the active principle of digitalis was stated to be digitaline. This was officinal in the B.P. of 1867, but has been omitted from the B.P. of 1885. Digitaline is still officinal I.P. Several varieties of digitaline have been prepared and sold, the chief being:—(1) Nativelle's crystallized digitaline, containing digitoxin as its chief constituent. (2) Homolle's amorphous digitaline, containing digitalin as its chief constituent. This is the digitalin of the I.P. and old B.P.; and (3) Soluble digitaline, a large proportion of which consists of digitalein.

Poisoning by digitalis is rare, and is chiefly due to accidents in the medicinal use of the drug. One celebrated homicidal case is, however, on record, viz. the case of Dr. de la Pommerais, a homœopathic practitioner, who was tried and convicted in Paris in 1864, of poisoning a woman named Pauw. The case was an assurance murder. Symptoms.—Digitalis in large doses acts to a certain extent like an irritant poison, causing, no matter how introduced into the system, nausea, vomiting, and often diarrhœa. Its main action, however, is exerted on the heart: the pulse becomes slow, the heart's action irregular, there is pallor of the surface and tendency to syncope, and finally the heart's action stops, and death occurs. Other symptoms of digitalis poisoning are dilatation of the pupils, disturbances of vision, slowing of the respiration, and suppression of urine. Salivation is often present, and convulsions are occasionally seen. Usually the mind remains clear to the last. Sometimes the administration of a series of medicinal doses of digitalis, is followed by a sudden outbreak of symptoms of poisoning. Digitalis, therefore, is generally stated to be a cumulative poison. **Preparations and Dose.**—Ordinary medicinal doses of the various preparations of digitalis are—of officinal digitaline, one-sixtieth to one-thirtieth of a grain; of the powdered leaves, half a grain to one and a half grains; of the tincture B.P. and I.P. (strength, two and a half ounces to one pint), ten to thirty minims; and of the infusion (strength B.P. 1885, fifty-six grains to one pint; I.P. sixty grains to one pint), two to four fluid drachms. Blyth estimates the maximum safe dose to be—of officinal digitaline, 0·03 grain; of the leaves, four and a half grains; of the tincture, forty-five minims; and of the infusion, one ounce, or about three times these quantities in twenty-four hours. The same authority considers that double these maximum safe doses would be likely to prove dangerous. A case, however, is recorded of recovery after taking one drachm of the powdered leaves, and another of recovery after swallowing two ounces of the tincture. Fatal period.—Rarely less than twenty-two hours. In one

[1] Another principle present in digitalis, viz. digitonin, is readily soluble in water, and appears to have an action like that of saponin. This action is to a certain extent antagonistic to that of digitoxin, digitalein, and digitalin, its tendency being apparently to depress instead of stimulate the heart's muscle.

case death occurred on the sixth day. Treatment.—Evacuate the contents of the stomach. Give tannic acid and stimulants. Administer aconite cautiously, and keep the patient recumbent. *Post mortem* signs. —Not characteristic. In some cases signs of inflammation of the mucous membrane of the stomach and intestines have been present.

White or Pink Oleander.

This sweet-scented Oleander [1] is the *Nerium odorum*, N.O. *Apocynaceæ*, vernacularly known as *Kaner* (Hind.), *Sweth karabi*

Fig. 64.—Nerium Odorum, ½.

(Beng.), *Alari* (Tam.), see Fig. 64. The shrub grows wild over the greater part of India, and is cultivated in gardens for its

[1] The goat feeds on the foliage with impunity, but Dr. Watt (*Econom. Diets*) states that it is fatal to camels and other animals and poisonous also to insects. One of its Sanskrit names, as noted by Dr. C. L. Bose, is 'destroyer of horses,' *aswamarala*. Dr. Honigberger was of opinion that the wild hill plant was more poisonous than the cultivated variety, and he is supported in this opinion by M. Latour and Prof. E. Pelikan, who found by careful analysis that the wild variety contained a larger quantity of the poisonous principle.—Dr. C. L. Bose, *Ind. Med. Gaz.*

graceful flowers. All parts of the plants are poisonous; but cases of poisoning by it are not very often reported. It is also called the 'true oleander' in contradistinction to the 'bastard oleander,' *Thevetia neriifolia* or *Cerbera thevetia* (see p. 682).

During the fifteen years ending 1888, fourteen cases of Nerium poisoning were referred to the Chemical Examiner, Bombay, and eleven to the Chemical Examiner, Madras; only two cases were dealt with by the Chemical Examiner, Bengal, during the same period. Of seventeen cases, nine were suicidal, two homicidal, two criminal abortions, and in four the poison was given medicinally.

For suicidal purposes the root is especially used by women in Western and Southern India and in the outer Himalayas; whilst in Bengal the fruit of the yellow oleander (see p. 683) is more often used in this way.

For homicidal purposes it is less frequently employed; but the root is commonly used for procuring criminal abortion both locally and internally. The use of the root medicinally by ignorant persons for venereal disease has occasionally led to fatal poisoning.

The active principles of the plant have been investigated by Dr. Chuni Lal Bose,[1] who discovered that the plant contains, in addition to the *Neriodorin* and *Neriodorein* of Greenish,[2] another actively toxic principle, which he has named *Karabin* after the vernacular name of the plant. Like *Neriodorin*,[3] it is a powerful cardiac poison, acting on the heart in a somewhat similar manner to digitalin, and it also acts on the spinal cord somewhat like strychnia.

Symptoms.—Vomiting and frothy salivation usually occurs, followed by restlessness. Pulse becomes slow and weak, respirations hurried, muscular twitchings, especially of upper extremities, deepening into tetanic spasms, which (unlike strychnia poisoning) affect one side more than another (thus, see *Cases* 1 and 2 below, the muscles of the right arm were chiefly affected in one case, and in another the left side). Lockjaw is frequently present. Drowsiness passing into insensibility and collapse. Diarrhœa is usually absent.

Cases.—**White oleander poisoning**—Accidental—Multiple. In 1898 two men were admitted into the Medical College Hospital, Calcutta, three hours after taking a cupful of a decoction of the root of *Nerium odorum*, which they had taken medicinally as an anodyne.

1. Mohammedan male, aged about 50. Vomited several times before and after coming to the hospital; vomited matter consisted of yellowish, frothy fluid. At the time of admission he was quite conscious, and able

[1] *Ind. Med. Gaz.*, Aug. and Nov., 1901.
[2] *Pharm. Journ.*, 1881, p. 873.
[3] The third principle *Neriodorein* is shown by Dr. C. L. Bose to be a saponin, with little toxic properties, so may be disregarded.

to speak and swallow; complained of no pain in the stomach; pulse small, soft, slow (about 60 per minute), but regular; respirations normal; eyes congested; pupils unequal, the right one being contracted. Two hours after admission, drowsiness and twitchings of the muscles of the hands were noticed. An hour after spasms were noticed, most marked in the upper extremities and face, but slight in the legs. There was no lockjaw, but dysphagia was a marked symptom, and the patient was unable to speak, although he appeared to understand when spoken to and frequently smiled vacantly. Respirations were hurried, and the pulse slow and small, about 50 per minute. Four hours after admission he began to get tonic convulsions of all the muscles of the body, especially of the upper extremities; no lockjaw. An hour after the whole body was found rigid, and there were lockjaw, twitchings of the fingers and bending of the neck towards the right; froth coming out from the mouth. The pulse was frequent (about 100 per minute) and the respirations hurried (about 70 per minute). About twelve hours after admission the upper extremities were found still rigid, but the lower extremities were flaccid; breathing was hurried and stertorous, and the pulse was frequent and small. Rigidity of the muscles began to disappear gradually, but the general condition of the patient became worse. The pulse began to fail, the breathing continued stertorous, and the conjunctival reflex was lost. The patient died about twenty-six hours after the ingestion of the poison.

Post mortem appearances. Dr. Gibbons held a *post mortem* examination about four hours after death, and recorded the following conditions: "Rigor mortis well marked; body still warm to the touch. Right pupil a little smaller than the left. Thumbs resting against fingers. Lungs, adherent behind, and very congested with fluid blood. Heart, right side full with blood, left side nearly empty; spots of subendocardial hæmorrhage on front wall and towards apex on both walls. Liver, spleen, and kidneys congested. Stomach contents, about 1½ oz. of greenish-yellow fluid and much mucus, no smell; stomach in folds with tops congested, mucous membrane congested, especially along the lesser curvature. Small intestine contents, yellow mucus, slight congestion of upper part of duodenum and a few scattered spots of congestion. Large intestine healthy, contained liquid fæces. Brain healthy. Trachea congested, and frothy liquid in the bronchi."

2. Mohammedan male, about 28 years of age. The symptoms in this case were similar to those in the first case, excepting that they were apparently of a comparatively mild nature: there were vomiting, slow and feeble pulse, hurried respiration, twitchings of the muscles of the upper extremities, which, however, developed about twelve hours after the ingestion of the poison, as against five hours in the first case; unequal dilatation of the pupils; bending of the head towards the right; general tonic convulsions of the whole body, opisthotonos; lockjaw. A movement of the head from side to side was noticed, and there was a slight rise of temperature on the second day of poisoning. Under treatment he began to improve steadily, but remained in a debilitated condition for about three weeks, after which he was discharged from the hospital cured. The treatment in both the cases consisted in giving emetics and alcoholic and diffusible stimulants, mustard plasters over the heart, and hypodermic injections of sulphuric ether. The viscera of the deceased man and the vomited matter of both men were sent to the Chemical Examiner for analysis. A narcotico-irritant principle was detected both in the viscera and in the vomited matter, which produced vomiting, weakness of the heart, general uneasiness and drowsiness in a cat, but not twitchings or convulsions. The poisonous principle could not be identified

by chemical tests.—Asst.-Surgn. Kalimohun Sen, *Ind. Med. Gaz.*, 1899, p. 118.

Cases.—**Nerium poisoning—suicidal.**—(*a*) A man, aged 35, after a quarrel with his wife, attempted suicide by swallowing rather more than an ounce of expressed oleander juice. After swallowing the poison, he is stated to have almost immediately fallen down insensible, and when admitted was insensible, with flushed face and stertorous breathing. There were violent spasmodic contractions of the muscles of the entire body, more developed in the upper than in the lower extremities, and on the left more than the right side. "During the intervals of spasm the patient lay evenly on his back; and when action commenced, the superior contractions of the left side threw him over on his right." After some hours the spasms decreased, the pulse sank to a thread, and the extremities became cold. Insensibility lasted about 36 hours. Under active treatment, however, the patient ultimately recovered.—Dr. Broughton, *Koldpur*, 1858, Chevers, *M.*, 256.—(*b*) A Hindu woman, Sundari Rawe, in Calcutta, in 1884, ate some of the bark of *Nerium odorum* to commit suicide. She was attacked by convulsions and became unconscious, but recovered after a time.—L. A. Waddell, *Beng. Ch. Ex. Rept.*, 1884, p. 16. —(*c*) A man in Sitapur, aged about 50, took some Nerium root mixed with mustard oil to destroy himself on account of a domestic quarrel. He was brought to the hospital about an hour and a half after the ingestion of the poison in an apparently insensible condition. The principal symptoms noticed in the case were: vomiting, preternaturally slow but regular pulse, and insensibility. The man was making favourable progress when, after making certain exertions, he suddenly died, probably from heart failure, about twenty-four hours after he had taken the poison. He never complained of any pain in the abdomen. At the *post mortem* examination small patches of congestion, with red points, were discovered near both the pyloric and cardiac ends of the stomach posteriorly; there were also two slight abrasions on the mucous membrane of the stomach. The cavities of the heart, particularly the ventricles, were filled with black fluid blood. Other organs were found healthy.—Dr. Greig, 1840.—(*d*) A man, aged 35, drank a strained watery decoction of 4 ounces of the root, and was attacked soon afterwards with vomiting and cramps. Insensibility came on in two or three hours. Eight hours after swallowing the poison he is described as becoming insensible, skin cold and clammy, pulse weak and thready; muscles of the jaws stiff; eyes turned up, whites only visible; hands pretty open, but fingers rigid, thumbs turned inwards. During the night had frequent convulsive spasms, and had not recovered sensibility when taken away from hospital by his friends 48 hours after swallowing the poison, and died on the fifth day.—Dr. Murray, *Ind. Med. Gaz.*, 1877, p. 319.

Post-mortem appearances.—Patches of congestion in the stomach and upper portion of the small intestine; congestion of the liver, lungs and kidneys; engorgement of the general venous system; both sides of the heart full of blood, but see cases above. **Treatment.**—The general treatment for digitalis and strychnine poisoning. Injections of ether and morphine seem to be beneficial.

Identification.—A shrub about six to ten feet high with linear lanceolate leaves and white or pinkish flowers (see Fig. 64, p. 677). The root is 'crooked,' bark thick, soft, external

surface grey corky ; on young roots the corky layer is very thin and the interior yellow colour of bark is seen through it, inner surface yellow. The bark when cut or wounded exudes a pale yellow latex which is resinous and very sticky. Odour somewhat acrid, like that of a raw potato. Taste acrid and bitter.

Tests.—The following tests are prescribed by Dr. C. L. Bose for the separation and identification of *Karabin* and *Neriodorin* in cases of poisoning by this plant.

Separation and identification of the poison in viscera, etc.—Extract obtained by Stas' process should be treated with water acidulated with a few drops of diluted sulphuric acid, and then agitated successively with ether and chloroform ; the former will take up any *Karabin,* and the latter *Neriodorin,* which may be identified: (1) by their producing the peculiar acrid pricking sensation on the tongue, followed by numbness ; (2) by their behaviour with concentrated sulphuric acid and fumes of nitric acid, and with concentrated hydrochloric acid and heat ; and (3) by the previously described toxic symptoms produced on animals.

Behaviour with Charcoal Reagents.

	Neriodorein.	Neriodorin.	Karabin.
Conc. H_2SO_4 ..	Maroon - brown passing to violet. On exposure to the fumes of HNO_3 or bromine, no change was noticed	Yellowish-brown ; on exposure to the fumes of HNO_3 or bromine, it immediately changes to a beautiful mauve-violet	Light brown ; on exposure to the fumes of HNO_3 or bromine, a faint violet-brown colour develops after some time
Conc. $H_2SO_4 + KNO_3$	No change	Reddish-violet colour	No reddish-violet colour
Conc. HCl + heat ..	No change	Dissolves to a yellowish solution ; no separation of flocks	Partly becomes soluble, forming a greenish-yellow solution with separation of flocks of a dark greenish-blue colour
Fehling's solution + heat	No reduction	Reduction	No reduction
Boiled for 3 hours with 2 per cent. HCl, neutralized with KOH, and then heated with Fehling's solution	Reduction	Reduction	No reduction

Fatal dose for an adult human being.—Half a grain of *Karabin* nearly proved fatal to a cat. Two grains of *Neriodorin* killed a cat in 15 minutes. One grain of either of these substances may, therefore, be considered to be the fatal dose for an adult cat. From an analogy of the action of other vegetable poisons on cat and man, it will be within the mark if the fatal dose of either of these principles for the latter be fixed at five times that for a cat. In the case No. 4 about 180 grains of the root produce alarming symptoms, but did not prove fatal. As the root contains about one per cent. of *Karabin*, and probably an equal amount of *Neriodorin*, 250 grains (about ½ ounce) of the root (which would yield 5 grains of the two active principles) may be taken as the average fatal dose for an adult human being. The *Neriodorein* of Mr. Greenish, which is a saponin only, may be neglected, as its toxic properties are of a much milder character than those of either *Karabin* or *Neriodorin*.

Yellow Oleander.

Cerbera Thevetia, or *Thevetia neriifolia*, Yellow or Exile or 'Bastard' Oleander; N.O. *Apocynaceæ*, *Pila-kanir* (Hind. and Bom.); *Kolkiphul* or 'yellow flower,' and *China Karab* or 'Chinese

Fig. 65.—Cerbera thevetia × ½.

oleander' (Beng.); *Pach-chai-alari* (*Tam.*) (see Fig. 65).—This plant, a native of the West Indies, but domesticated in India, is highly poisonous. It contains a glucoside, *thevetin*, a powerful heart poison, acting similarly to digitaline. It is

chiefly used as a poison for suicide or by women who take it as an abortifacient. In Bengal it is especially used in Midnapur and Orissa. Of late years the seeds have come into somewhat extensive use in some parts of the Bombay Presidency as a cattle poison.

Symptoms.—The more prominent of these are a burning sensation in mouth, with tingling of tongue and dryness of the throat, vomiting and purging, with drowsiness and dilated pupils, and depression of the heart's action somewhat resembling digitalis, like which its symptoms may be divided into the stages of (1) excitation, (2) depression, and (3) paralysis. In one case a child *æt.* three, died with symptoms of tetanus after eating one seed, and in another case eight to ten of the seeds proved fatal to an adult female. A tincture of the bark has been used in medicine as an antiperiodic; thirty to sixty drops of a tincture, strength one to five, acts as a purgative and emetic.

Case.—**Yellow oleander poisoning**—Suicidal.—A Hindu woman in the Contai District of Lower Bengal, in 1884, committed suicide by

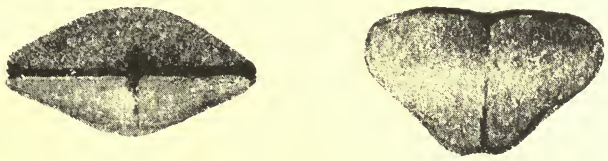


FIG. 66.—Cerbera thevetia Nuts. (*Nat. Size.*)

eating the seeds, some of which, together with the flowering tops, were sent for identification.—L. A. Waddell, *Ben. Chem. Ex. Rept.*, 1884, p. 16.

Cases.—**Suicidal cases.**—(*a*) Surju Bewah, a young Hindu widow, resident of village Jhowa, under the jurisdiction of Contai Thana, rubbed two seeds of yellow oleander with treacle on a mortar, and swallowed them down on the 5th June, 1897, to procure abortion. Almost immediately after taking the poison she felt a burning pain in the throat, vomited and purged several times, became much prostrated, and had several fainting fits. She was brought to hospital by the police on the following day, when her pulse was found to be very soft, compressible, and slow (52 in a minute); the pupils were normal, and acted on by the stimulus of light; mind clear, skin soft and perspiring; she felt giddiness in the head, felt thirsty, and was much troubled with a dragging sensation in the tongue. These symptoms gradually disappeared, with the exception of slowness of the pulse and giddiness in the head, which lasted till the 9th of June, when she gave birth to a healthy male child. The Chemical Examiner detected the presence of the active principle of the poison in the deposit on the stone on which the seeds were rubbed with treacle. (Report No. 1024B, 11th August, 1897.) She was tried by the Sessions Judge of Midnapore, and was sentenced to six months' imprisonment.

(*b*) Wedennissa Bibi, a Mohammedan female of Jalakhabad, a village close to Contai, took two seeds on the 18th September, 1897, to commit suicide. She was admitted into hospital on the following day, suffering from purging, vomiting, pain in the throat, with severe headache and fainting fits, alternating with drowsiness; pupils normal and acted on by light; her heart-sounds were weak, and her pulse was soft, feeble, and compressible (36 in a minute). It remained so for three days; the headache and giddiness gradually disappeared with the rise in the tone and frequency of the pulse. She was tried by the Subdivisional Magistrate of Contai, and sentenced to three days' imprisonment. (*c*) Dainu Bewah, a Hindu widow of village Aori, under the jurisdiction of Contai Thana, took two seeds on the 12th February, 1898, after a quarrel with her sister-in-law. She was admitted into hospital with purging, vomiting, headache, and giddiness in the head; her heart-sounds were very weak, and pulse was 140 in a minute,

FIG. 67.—Cerbera odallam.

soft, irregular, compressible, was much troubled with a griping pain about the navel. The improvement in the pulse commenced with the abatement of headache and giddiness. She was tried by the Subdivisional Magistrate of Contai and sentenced to one week's imprisonment. (*d*) On the 24th November, 1898, Kumar Jana fell ill with purging, vomiting, giddiness in the head, and fainting fits after taking a meal of stale rice, left in an open pot by his wife, with whom he was not on good terms. He was brought to me for examination by the police on the night of the 27th November, when I found his pulse soft, compressible, and slow (52 in a minute); he looked dull, and walked with a slow and unsteady gait. I

gave my opinion that he was convalescing from *korobi* poisoning, which police, on inquiry, found to be correct. From the above cases it appears that this poison is used by women, not only to commit suicide and procure abortion, but also for homicidal purposes. The poison is a virulent cardiac sedative; it causes death by the failure of the action of the heart. I treated first three of my cases with brandy, and was satisfied with the result. I was afraid to try the hypodermic injection of strychnine. In case (*c*) I was obliged to inject ether hypodermically.—Asst.-Surgn. Jadub Kisto Sen, *Ind. Med. Gaz.*, 1901, p. 412.

Case.—**Oleander as Cattle-poison.**—Oleader was found on a bloody rag from the dung of a bullock suspected to have been poisoned from Saran.—Hemnath Adhikari in *Beng. Chem. Exr.'s Rept.*, 1919.

Identification.—A tree about 12 feet high, with large yellow bell-shaped flowers 3 inches in length, and linear lanceolate leaves about 5 inches long by $\frac{1}{4}$ inch wide. All parts of the plant abound in milky juice. The fruits are globular, light-green, about $1\frac{1}{2}$ to 2 inches in diameter, and contain a single nut, light-brown in colour, and of a peculiar triangle shape (see Fig. 66), with a deep groove along the edge corresponding to the base of the triangle: each nut contains two pale yellow seeds.

Tests.—The seeds and the inner layer of the bark give, when boiled with hydrochloric acid, a deep-blue or bluish-green colour. Fragments of the seeds may be recognized as follows:—Exhaust with alcohol, filter, and evaporate the tincture to dryness. The residue may then be washed with ether, and the washed residue tested as follows: (1) A portion warmed with hydrochloric acid gives a deep bluish-green colour, destroyed by permanganate of potash solution. (2) A portion treated with strong sulphuric acid gives a brown colour, changing slowly into a rich crimson, which, on exposure, becomes deep-green at the edges.

This crimson colour, Dr. E. A. Hankin finds, develops best in the presence of traces of alcohol. The vomit of a person poisoned with Cerbera gives a blue colour when boiled with hydrochloric acid. Another specimen of the vomit should, in this case, be evaporated to dryness. On adding concentrated sulphuric acid no crimson colour appears. The acid should be poured off, and a few drops of alcohol poured over the residue. The crimson colour then appears. If a dry seed of Cerbera is crushed and placed in concentrated sulphuric acid, a strong crimson colour will develop on the addition of a few drops of alcohol.

Dr. C. L. Bose notes that besides the deep bluish green colour which the fresh bark or seed gives with warm hydrochloric acid (a test discovered by the late Dr. C. J. H. Warden), the seeds yield to the ethereal extract by Stas' process a

white crystalline deposit (not an alkaloid, but more probably a glucoside) which, when applied to the tongue, produces a burning sensation accompanied by tingling, which often extends to the lips. There is also dryness of the throat. This sensation generally lasts from half an hour to one hour, though the tip of the tongue may remain benumbed with a rawish feeling for a longer time. This sensation is not likely to be mistaken for that produced by *Aconitine* on the tongue, which lasts for more than six hours, and is of a less burning and more tingling character.

Cerbera odallam (see Fig. 67).—This plant, closely allied botanically to the last, probably contains the same poisonous principle. Like the plant last described, it also abounds in milky juice, and this and the seeds when heated with hydrochloric acid give a deep blue or bluish-green colour, similar to that given by *Cerbera thevetia*. The flowers are jasmine-shaped, white, about 1 inch in length; the leaves are dark green, fleshy, and lanceolate, about 4 to 5 inches long, by 2 inches in greatest breadth. Fruits nearly globular, dark green, and contain in a cavity in the centre a single oval white seed.

Aconite.

Aconite is one of the most virulent poisons known. All the aconites (N.O. *Ranunculaceæ*) are poisonous, and some so extremely so that the general Indian vernacular name for them is *Bish* or *Bikh*, meaning '*the* poison.' The most poisonous species are *A. ferox* and *A. napellus*, which Hooker was inclined to think were merely varieties of the same species. All parts of these plants are poisonous.

A. ferox (see Fig. 68) is a native of the Himalayas, and its root forms most of the aconite root of the Indian bazaars. It is believed to be even more actively poisonous than *A. napellus*, to which it is generally similar in appearance.

A. napellus, or 'monk's hood,' 'wolf's bane' or 'blue-rocket,' is a common plant in England and grows also in the Himalayas. Its root and leaves are officinal. It is perennial, two to three feet in height, with dark-green digitate leaves and an erect terminal spike of blue helmet-shaped (hence called 'monk's hood') flowers. Other extremely poisonous species are *A. luridume* from Sikhim, and *A. lycoctonum* from Kashmir to Kumaon. Less poisonous species of aconite are:—*A. palmatum* in the eastern temperate Himalayas from Garhwal to Mishmi Hills in Assam, and *A. heterophyllum* in the North-western Himalayas. The root of the former is known in the vernacular as *Bikhma*, *Bishma* (Hindi), *Wakhma* or *Vakhma* (Bombay), and of the latter as *Atis* (Hindi), *Ativisha* (Maratha), *Ativadayam* (Tamil), *Atavakha-in-kali* (Gujerati). The roots of these are smaller than those of the stronger species. They are used in native medicine as tonics and antiperiodics. Their alkaloids differ from aconitia.

The **root,** sold in the Indian bazaars, is mostly derived

from *A. ferox*, and is known under the names of *Bish*, *Bikh*, or *Bachnag* (or snake-bite preserver), *Mitha-bish* (sweet-poison), or *Mitha-teliya* (Hindi), *Bach-nab* (Bo.), *Vashnavi* (Tamil). It is met with in two forms :—(1) Conical roots, see Fig. 69, three to four inches long, and half to one and three-quarters inches in

Fig. 68.—Aconitum ferox × $\frac{3}{4}$.

greatest diameter, shrivelled with longitudinal wrinkles, and often flattened and arched. Externally they are blackish-brown ; internally, from being dried over a fire, they are generally hard, horny, and brittle, and on section darkening slightly on exposure to the air. (2) The same roots, after subjection to some soaking process, generally stated to be soaking in oil (hence called *telyia*) and cows' urine. These are black, plump, conical tubers, cylindrical in section, tough and moist, and staining the fingers

brown when fresh. When dry, they are hard and brittle, and have a reddish-brown resinous fracture. They have a strong offensive odour.

Atis tubers are smaller, and *Bikhma* tubers about the same size as those of *A. ferox*, but branched. Both are externally much lighter in colour than the tubers of *A. ferox*. Both taste simply bitter, without the tingling and numbness. The root of *A. napellus* is carrot-shaped,

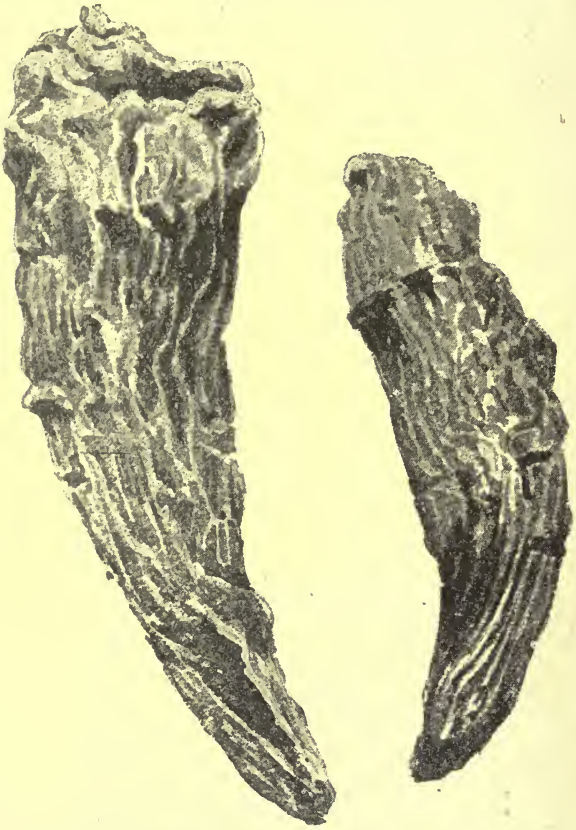


FIG. 69.—Aconite Root (*Aconitum ferox*), natural size.

two to four inches long, by half an inch to an inch thick at the top, dark-brown externally, and whitish within. The fresh root has numerous long thin curling rootlets attached to it. The dry root is shrivelled longitudinally and breaks with a short fracture. Chewed, it causes tingling and numbness of the lips, etc. It may be distinguished from horse-radish root, which is cylindrical, longer than aconite root, and externally of a light-buff colour. Rootlets attached to it are straight; chewed, it has a pungent taste, but does not cause tingling and numbness like aconite

root. *A. ferox* is extensively collected for commerce from Sandukphu,[1] a mountain near Darjiling.

The chief active principle of *A. napellus* is aconitine, while *A. ferox* owes its activity mainly to *pseudo-aconitine* which, although differing somewhat in composition and chemical properties, has the same physiological action as aconitine. Other less active alkaloids, some of which are not poisonous, are contained in both species, two of which, *aconine* and *pseudo-aconine*, are obtained by the action of heat from aconitine and pseudo-aconitine respectively.

Aconitine is one of the most active poisons known, if not the most active. It crystallizes with difficulty, so is usually met with as a white amorphous powder. The various kinds of commercial aconitine differ considerably in activity owing to more or less admixture with the other relatively inert alkaloids in the root of their derivatives.[2] English aconitine (Morson's) is more active than the German and is not bitter, but slightly soluble in water, but not very freely soluble in alcohol and ether, while the German alkaloid is soluble in all three and is bitter; this is owing to its containing a considerable proportion of the less active alkaloids, namely, *aconine*, which is 2000 times less active than aconitine, and *benzaconin*, which is 200 times less toxic.[3]

The activity of Morson's aconitine seems similar to that of the French. Dr. Harley found that $\frac{1}{1000}$ of a grain of Morson's aconitine nearly killed a cat weighing 3 lbs., whilst two other cats weighing 3 lbs. each died in $7\frac{1}{2}$ hours and $\frac{3}{4}$ of an hour respectively from a subcutaneous dose of $\frac{1}{500}$ grain, which is equivalent to 0·092 mgrm. per kilo of body weight for cats. But man is much more sensitive, as 1·6 mgrm. of French (Petits') aconitine nearly proved fatal, whilst 4 mgrms. by the mouth was rapidly fatal, and it is probable that 1·5 mgrm., if injected subcutaneously, would prove fatal. The medicinal dose of the B.P. tincture, 5 to 15 minims, equals approximately 0·005 to 0·015 grain of aconitine; and 2 mgrm. of aconitine = 0·030 grain of the alkaloid or about 30 minims of the B.P. tincture.[4]

Poisoning by the root.—In India the root is extensively used by the wilder tribes of the Himalayas from Assam to Kashmir to poison arrows for the chase as well as for inter-tribal conflicts. In our military expeditions on the North-Eastern Frontier in Sikhim, Bhutan and Assam, several of the Sepoys have been mortally wounded by these poisoned arrows.

[1] *Among the Himalayas*, by L. A. Waddell, pp. 324–326. The name of this mountain, San-duk-phu, means, as Colonel Waddell first pointed out, "the hill of the aconite-plant."

[2] See Blyth's *Poisons*, 352; and Allen's *Commercial Analysis*, iii., Pt. II., for details.

[3] J. T. Cush, in *Beng. Med. Jour.*, October 8, 1898.

[4] Blyth, *Poisons*, 357.

Several of these poisoned arrows used against our troops in the Aka expedition of 1884 were sent to Dr. L. A. Waddell for examination and analysis, and the arrows were found to be smeared over with a paste containing aconite[1] (see figs. p. 112). The arrowheads were made of bamboo ingeniously contrived to carry the poison into the wound, and retain it there. For this purpose the surface of the arrowhead was sliced obliquely to form little pockets or valves, whilst others were constructed of dovetailed pieces tied together, and so arranged that any one trying to pull the arrow out of the wound merely pulls out the shaft and forces the barb and sharp splinters more deeply into the flesh (see illustration, p. 112). Septic blood is said to be mixed with the pounded root to increase its lethal effects.

The Lepchas of Sikhim have a saying that aconite is "useful to hunters for destroying tigers and elephants, useful to the rich for putting troublesome relatives out of the way, and useful to jealous husbands for destroying faithless wives." The Lepchas poisoned with aconite root the water-supply of a detachment of British troops during the expedition of 1887. Similarly the Burmese during their retreat before the British in 1842 threw bruised aconite root into a tank in the hope of poisoning the troops pursuing them[2]; and the Gorkhas did the same in the wells in the Saran tarai against General Ochterlony's troops in the Gorkha War of 1814–16.

Accidental poisoning by aconite is occasionally met with as a result of its common occurrence in bazaars and its use as the drug by native quacks in the treatment of fever, etc. (see *Cases*, pp. 693–94); also from native alcoholic liquor, to which it is added occasionally (like datura) for the purpose of conferring additional intoxicating power,[3] sometimes with fatal results. **Homicidal** cases are not unfrequently reported (see *Cases*, pp. 691–92), but are not so frequent as one might expect, considering how readily the drug can be obtained, and how well known are its poisonous properties. It is sometimes administered to the victim with betel-pepper,[4] so as to disguise its tingling taste.

In 1898 in Madras aconite accounted for the largest number of deaths from poisoning with any organic poison, 14 persons having died out of 22 affected in 7 cases (*Mad. Chem. Ex. Rept.*, 1898); and Burton Brown records only nineteen cases in the Panjab in the years 1861–73. In Bengal, etc., for the three years ending 1872, only ten certain cases were recorded (five of them homicidal, and five doubtful cases); but of late it has increased. The Bombay Analyser's Reports for the ten years ending 1884 show only six cases, three of them accidental.

[1] See *Beng. Chem. Rept.*, 1885.

[2] Wallich, quoted by Chevers, *Med. Jur.*, p. 136.

[3] It may be mentioned here that a non-poisonous bark, namely that of *Acacia leucophlœu*, *Hewur* (Mar.) is used in the South Concan in distilling liquor. It contains much tannin, and precipitates albuminous matters present in the juices from which the liquor is distilled: hence its employment.

[4] L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 13; and Dr. Hamnath Adhikari, *id.* 1919.

In Europe, aconite is rarely used for criminal purposes. According to Blyth, in the ten years ending 1882–83, eighty-seven cases of aconite poisoning were recorded in European medical literature, of which two were homicidal, seven suicidal, and seventy-seven accidental. It should be noted that in Europe, accidental cases sometimes arise from aconite root being eaten in mistake for horse-radish.

Action and Symptoms.—Aconitine or aconite root itself first stimulates the sensory nerves, producing tingling, and then paralyses the sensory nerve-terminals, causing numbness. It produces similar effects on the motor nerves and centres of the medulla and cord, while the higher cerebral centres are little affected. The motor ganglia of the heart are paralyzed, the respiratory centre is slowed, death being usually due to arrest of respiration. The temperature sinks from the outset. **Symptoms.**—Aconite causes tingling followed by numbness; first, of the parts with which the poison has been in contact, *e.g.* the lips and tongue, and subsequently in all parts of the body. This tingling, followed by numbness, is a characteristic symptom of aconite poisoning. Irritation of the stomach is also caused; hence vomiting, sometimes violent, is generally a constant feature. There may be diarrhœa. From its paralyzing action on the motor nerves (or centres), and on the heart, other symptoms of aconite poisoning are:—great muscular weakness: the patient staggers if he attempts to walk: the respiration becomes slow and weak, and the pulse slow, weak, and irregular. Death may occur from shock or syncope, but usually occurs from asphyxia due to paralysis of the respiration. Convulsions may precede death. The pupil in the early stages of the case alternately contracts and dilates, but becomes widely dilated in the later stage. The mind is usually quite unaffected, but in exceptional cases delirium has been observed. The case below well illustrates the symptoms of aconite poisoning.

Case.—**Typical aconite poisoning.**—Homicidal.—In 1902, Monorath, a shopkeeper in the Terai, was charged at Almora with murdering a fellow villager by poison. The evidence showed that the accused gave refreshment of tea to several of the villagers, including the deceased, with which latter person the accused was at enmity. After helping all the others, accused asked deceased to bring some water from the river, and prepared, during deceased's absence, another cup of the tea, which he gave to deceased, who immediately remarked that it caused a tingling and 'pricking' of his lips and mouth, and a 'burning' of throat with nausea and a 'twisting pain' in the stomach, whereupon he taxed the accused with having poisoned him. The tingling of the lips and mouth were soon followed by numbness, and a free flow of saliva and vomiting occurred. Within less than half an hour the tingling and numbness extended to his arms, legs, and whole body, which had darting pains as if being 'torn,' he had dimness of vision, giddiness, staggering, and was unable to walk without assistance. He then lost power over his legs and remained lying prostrate,

complaining of intense faintness. His pulse became feeble, respirations jerky and laboured, and limbs grew cold and moist to the touch. He grew gradually weaker and drowsy, and died within two hours of taking the poison. The *post mortem* examination showed that the stomach lining was bright red and contained some bile; the small intestines contained a large amount of solid fæces, which negatived cholera, which with its cramps in the limbs had been put forward by the defence as the cause of death; the brain and venous system generally were darkly congested. In the contents of the stomach an alkaloid was found possessing the properties of aconitine.—L. A. Waddell, Civil Surgeon, Almora, 1902.

Cases.—**Homicidal aconite poisoning by liquor drugged with aconite.**—(*a*) In 1834, about 70 men, 18 of whom died, were poisoned at Benares by drinking Mowa liquor obtained at a particular liquor shop. One of the servants at the liquor shop afterwards confessed to having put aconite root into the liquor.—Chevers, *Med. Jur.*, p. 138. (*b*) In a case from Morsi (Hyderabad Assigned Districts), a small bundle, taken out of the receiver of a country liquor still, was on examination found to contain a quantity of fragments of aconite root. Of eleven persons who had drunk liquor bought at the shop of the owner of the still, ten, it was stated, suffered from slight symptoms of aconite poisoning; the eleventh, who had drunk about a quart of the liquor, died.—*Bo. Chem. Analyser's Rept.*, 1884. (*c*) *In pachwai.*—Several persons drunk *pachwai* in a liqour shop in the district of Birbhum. Soon after they all suffered from severe burning sensation in the stomach, tingling and numbness of the extremities and vomiting. Six of these persons died, and congestion of the stomach and other internal organs was found in most of the cases on *post mortem* examination. The viscera of the six persons were sent for chemical analysis, and aconite was detected in three of them. The vomited matter of some of the deceased and a sample of the *pachwai* which they took were also forwarded for analysis, and aconite was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Cases.—**Homicidal aconite poisoning by food.**—(*a*) In 1899 a Mohammedan, Adibuddi, of Patuakhali in Bengal, was given some poison mixed with food by his wife Moina Bibi. He vomited and purged soon after, but ultimately recovered. Aconite was detected in the vomited matter. The wife confessed to the police that she had mixed some powder with the food of her husband in order to poison him. A portion of this powder was also sent for examination, and it was found to contain aconite. L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(*b*) (*Beng. Medico-legal Rept.*, p. 277). In a case reported from Gujranwala by Mr. R. C. Bose, a woman confessed to having killed her son-in-law, *æt.* 30, by administering to him half a tola (90 grains) of aconite root. "She said that about half an hour after the imbibition of the poisons the man began to complain of pain in the stomach, numbness, tickling sensation in the throat, and subsequently of severe vomiting, followed by coldness of the extremities, collapse and rigidity of the hands and fingers. Death took place in seven hours."—(*c*) In Dinapur in Northern Bengal, in 1884, a young Mohammedan, aged 19, was reported to have died by purging and vomiting after taking milk given to him by his step-mother, who was suspected of deliberately poisoning him. Aconite was detected in the stomach, liver, and vomited matter.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 12.—(*d*) A Gorkha Sepoy, at Dibrugarh in Assam, in 1884, had poison placed in his food by his wife between 7 P.M. and 8 P.M. On admission to hospital immediately after, he complained of tingling and numbness of lips and tongue, and pain in stomach. Latterly giddiness supervened, the tingling

and numbness extended to his arms and legs, and he vomited. Skin became cold and moist, pulse small and thready, difficulty in breathing set in and he died at 8.30 P.M. He was sensible up to time of death. The *post mortem* examination held sixteen hours after death showed pupils widely dilated, brain much congested and its substance studded with minute points of ecchymosis, lungs much congested, heart normal, stomach distended somewhat with food, mucous lining injected, small intestine congested. Aconite was found in the stomach contents.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 13.—(*e*) The assistant-surgeon of Madaripur referred a case of aconite poisoning with the following history: A Mohammedan was given some food cooked by his wife. Soon after he felt very bad, vomited, and was purged, and died in about two or three hours. The *post mortem* examination revealed congestion of the mucous membrane of the stomach, *which still contained much undigested food.* The small intestine also presented a red appearance. The lungs and the liver were intensely congested; the brain, the spleen and kidneys were also congested. The viscera and the vomited matter of the deceased were forwarded for examination, and aconite was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1906.

Cases.—**Accidental aconite poisoning.**—(*a*) (*Bo. Chem. Analyser's Rept.*, 1875–76). In a case from Coompta a woman, after taking medicine given to her by a quack for menorrhagia, suffered from "restlessness, depressed and irregular heart's action, coldness of the surface, numbness and tingling of the lips, tongue, and extremities, spasm of the diaphragm, and difficult respiration." The woman recovered under treatment; aconite was detected in the vomited matter.—(*b*) (*ib.* 1877–78). A man was admitted into the Jamsetjee Jeejeebhoy Hospital, Bombay, suffering from symptoms of aconite poisoning. On inquiry, it turned out that he had been taking pills supplied to him by a native hakim. Some of these pills, on examination, were found to contain cinnabar and aconite. —(*c*) (*ib.* 1879–80). At Mahad, in the Colaba district, a man, the servant of a native hakim, swallowed some of the preparation of aconite root he was making for his master; death resulted, and on analysis aconitia was found in deceased's viscera.—(*d*) A Tibetan, a Buddhist priest at Jalpaiguri in 1884, bought several articles of food which he cooked and partook of with his friend at 9 A.M., and within an hour was attacked with a burning pain in the stomach and raging thirst, and died at 4 P.M. the same day. His friend, who had eaten less, was seized with similar though less severe symptoms. He complained of tingling in the mouth and throat, numbness in limbs, dimness of vision and giddiness, and after a time became unconscious. In the afternoon he recovered consciousness, and on admission to hospital had dilated pupils, incessant thirst and vomiting, pulse weak and irregular. He ultimately recovered. In the fatal case the *post mortem* examination showed:—Pupils dilated, internal organs generally congested, stomach highly congested and coated with bile. The stomach and its contents with portion of the liver were sent for analysis, and aconite was found in them.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 11.

Fatal period.—Shortest recorded, twenty minutes; longest, twenty hours; usual, within three or four hours. Fatal dose.—Of the root, one drachm (presumably of the root of *A. napellus*) has caused death. Chevers,[1] however, mentions a case in

[1] *Med. Jur.*, p. 143.

which fifteen grains of Indian aconite root gave rise to severe symptoms, and bad symptoms have been produced by inhaling the dust arising whilst powdering the root.[1] The tincture of aconite B.P. and I.P. is prepared from the root of *A. napellus*, strength two and a half ounces to one pint. The medicinal dose of it is five to fifteen minims. Taylor[2] mentions two cases in which one drachm of the tincture caused death, and a case is reported in which fifteen minims of the tincture caused severe symptoms. In these three cases the tincture was probably that of the old London Pharmacopœia, which was three times as strong as that of the B.P. Another tincture of aconite, known as Fleming's Tincture, is three or four times as strong as the B.P. tincture.[3] A case is reported in which death is believed to have occurred from the too frequent external application of **Neuraline,** a preparation containing Fleming's Tincture. Another officinal preparation of the root is the liniment—strength I.P. one to one, B.P. two to three. Lastly, the B.P. and I.P. both contain an alcoholic extract of the leaves (of *A. napellus*), medicinal dose one-sixth of a grain gradually increased. Two grains of the extract has caused death. One-fiftieth to one-fortieth of a grain of aconitine has caused alarming symptoms. Probably one-twentieth to one-sixteenth of a grain given by the mouth would usually cause death in an adult. Blyth considers that the minimum fatal dose, when given by the mouth, is even less than this, and that probably about one-fortieth of a grain subcutaneously injected would cause death. The only officinal preparation of aconitine is an ointment, strength eight grains to the ounce.

Case.—**Homicidal aconite poisoning.**—Multiple.—On 6th May, 1891, three coolies of the *chamar* caste were found lying dead in the Dharamtola market; two others were unconscious, but subsequently recovered. The investigation showed that all five men had been poisoned with aconite mixed in their food by one Jitu Chamar at the instigation of Sanu Chamar. All concerned were fellow-countrymen and had been friends up to the time of the act, the cause for which apparently consisted in the fact that one of the murdered men had a quarrel with Jitu Chamar, who thereupon introduced poison into the common meal of five individuals *with four of whom he was not in any way at variance.* No example could be more striking of the recklessness of the poisoner on the one hand, or on the other of the small provocation required in some instances to induce the act.—C. L. Bose, *Proc. Med. Cong.*, 1894.

Case.—**Homicidal aconite poisoning.**—Lamson Case.—George Lamson, aged 29, a surgeon, was committed in London in 1882 for the murder of his brother-in-law Percy John, aged 19, a cripple, who had property which would, on his death, revert to Lamson's wife, John's sister. On November 24th, 1880, Lamson purchased two grains of aconitine, and on

[1] Woodman and Tidy, *For. Med.*, p. 394. [2] *Poisons*, p. 756.
[3] Blyth, *Poisons*, p. 334.

December 3rd went to the school where the lad was, and during an interview gave him a capsule which he filled at the time with a white powder alleged to be sugar. Lamson then left, and within 15 minutes John became ill, violent vomiting set in with pain in stomach, constriction of throat, and he died within three hours and three-quarters after swallowing the capsule. The viscera, vomit, etc., were analysed by Dr. Stevenson, of Guy's Hospital, who found aconite present in the viscera, contents of stomach and urine, and he considered that the vomit contained a quarter of a grain of aconitine. Sentence of death was passed. An attempt was afterwards made to get him off on the ground of insanity. It was urged that he had long been very eccentric, was in the habit of using enormous doses of morphia and opium as hypodermic injections, and had for a long time had a morbid habit of prescribing dangerously large doses of aconite for almost every disease. The Home Secretary refused to interfere, and he was executed.

Case.—**Aconite as Cattle-poison.**—In a case of suspected poisoning of a horse in Singbhum, Aconite was found in the viscera.—Hemneth Adhikari, *Beng. Chem. Exr's. Rept.*, 1919.

Treatment.—Evacuate contents of the stomach, administer animal charcoal and stimulants. Keep the patient in a recumbent posture, apply friction to the surface and keep up artificial respiration. Blyth recommends hypodermic injection of atropine (4 drops of B.P. solution), repeated from time to time, and if tendency to syncope, tincture of digitalis in half-drachm doses by the mouth or ten-drop doses subcutaneously—see following case.

Post mortem signs.—General venous congestion, congestion of the brain and its membranes, and frequently, if the poison has been taken by the mouth, some signs of gastro-intestinal irritation.

Detection.—**Aconitine** (or pseudo-aconitia) may be extracted from organic mixtures by Stas' process, p. 545, conducting the evaporation at as low a temperature as possible, and using a mixture of chloroform and ether as a solvent. There are no reliable special colour tests for these alkaloids. They may, however, be identified by physiological tests, namely, by the tingling and numbing sensation produced by a cautious application of a solution of the alkaloid to the tongue or lip, and by the effects produced by administration of the alkaloid to smaller animals.

The Goat for physiological Aconite tests.—As the physiological test is the chief one for aconite, and aconitine is one of the most deadly poisons known, it is undesirable that the chemical analyist should run unnecessary personal risks in detecting the poison for State prosecutions. The goat has been found by Major Black, Punjab Chemical Examiner (1916), to be very successful. He writes: "The Civil Surgeon, Gujranwala, forwarded certain articles in connection with a case in which it appeared that a woman had attempted to poison two other women. No history of the case nor statement of symptoms was given, but *datura* was indicated

as the poison probably used. Among the articles forwarded was a brownish, black powder which was apparently of a vegetable nature, but could not be identified under the microscope, also a capsule or pod of *datura*, these articles having presumably been found in the possession of the accused. As a preliminary test, a small quantity of an ethereal extract of the brown powder was introduced into the eye of a kid, in order to observe whether the dilatation of the pupil characteristic of *datura* resulted. The symptoms noted were: 'In 20 minutes great muscular weakness, staggering gait, the animal appearing to lose control of all its limbs, and occasionally falling down, the forelegs in particular seem to give way at the knees even when the animal stands still. Breathing laboured and irregular. No dilatation of the pupils.' The symptoms passed off in a few hours, and next morning the kid was quite well. *Aconite* was at once suspected from the above symptoms, and the case subsequently proved to be one of combined *aconite* and *arsenic* poisoning. The only reason for suspecting *datura* appears to have been the presence of the *datura* capsule noted above. The medico-legal interest in the case lies in the marked symptoms that followed the introduction of a very small quantity of *aconitine*, the active principle of aconite, into the goat's eye, and the possibility that this might be utilized as a toxicological test for aconite."

It has been already mentioned that veratrine has a similar action to aconitia on the sensory nerves. In addition, quebracho bark, the bark of *Aspidospermo quebracho*, N.O. *Apocynaceæ*, used in medicine to allay dyspnœa in asthma, etc., and containing several alkaloids, among them aspidospermine and quebrachine, has a paralyzing action on voluntary movement and respiration, and appears, therefore, to be a spinal poison. Tobacco and lobelia, also, are spinal as well as cardiac poisons.

The importance of sending, in every case of suspected poisoning, the vomited matter as well as the viscera from fatal cases is illustrated in the following cases:—

Cases.—**Detection of aconite poisoning in the vomit and not in the stomach.**—(*a*) A resident of Dinajpur prepared one morning his usual curry, one half of which he ate and the other half he reserved for his evening meal. On return from his day's work he mixed this curry with his freshly cooked rice, and whilst eating it was attacked by vomiting and purging, and died next morning. The *post mortem* examination showed: throat and gullet to cardiac end of stomach in a highly congested state. The medical officer forwarded for analysis (1) the stomach and its contents; (2) two pieces of the liver; (3) matter vomited by deceased; and (4) some of the food of which deceased was partaking when attacked. On chemical examination no poison was found in the stomach and its contents, nor in the liver; but aconite was found both in the vomited matter and in the food. Hence had only the stomach and its contents and liver been sent for examination, the poison could not have been detected.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 5.—(*b*) In Lakhimpur in Assam, in 1884, a Hindu named Sukla was reported to have been poisoned by a vegetable curry given him to eat. The man exhibited the symptoms of aconite poisoning. The *post mortem* examination showed the stomach to be intensely congested internally in patches and contained bloody and flaky mucus. Intestines irritated in patches; kidneys intensely congested; also lungs; heart relaxed. Aconite was not detected in the stomach and contents, but only in the vomited matter.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 5.

In view of the minute quantity of the poison usually used to produce a fatal result, and in view of its liability to decompose, it is probable that it has never been detected after absorption into the tissues. It may be found in the contents of the stomach before absorption, and also, more frequently, may be detected in the vomit. In a case that occurred in the United Provinces it was detected in a stain on the pyjama of a woman, but it could not be found either in the vomit or in the viscera. The vomit in this case had been mixed with wood ashes. Such ashes contain a quantity of alkali. Alkali is known to decompose aconite. Ashes are frequently used in clearing up a mess of vomit if vomiting has occurred inside a house. By a series of experiments Dr. Hankin discovered that wood ashes have the power of slowly destroying aconite, and that this power was due to the presence of alkali. The addition of alcohol to a mixture of ashes and aconite was found to check the decomposition. The decomposition was found to be still further checked if acetic acid was added besides alcohol, though the quantity of acid used was not sufficient to neutralize the whole of the alkali present.

The **Colchicums** which exert an asthenic action on the heart have already been described amongst the irritant vegetable poisons, see p. 550.

Hydrocyanic or Prussic Acid.

Poisoning by hydrocyanic acid, common in England, was some years ago almost unknown in India. Of late years, however, a few suicidal cases have been reported by the acid and by cyanide of potassium, see *Case*, p. 701.

Pure undiluted hydrocyanic acid rapidly decomposes, and is not met with in commerce. Dilute hydrocyanic acid, the form in which the acid is used as a poison, is officinal in the Pharmacopœias. The dilute acid of the British and Indian Pharmacopœias contains 2 per cent. of anhydrous hydrocyanic acid; that of various foreign Pharmacopœias ranges from this strength to 10½ per cent. (Paris Pharmacopœia) or even more. An acid met with in commerce called Scheele's acid contains 5 per cent.

Certain portions of many plants contain hydrocyanic acid, or yield it under appropriate treatment, owing to the decomposition of amygdalin, or substances allied to amygdalin (see 'Essential oil of bitter almonds'). Hydrocyanic acid swallowed, inhaled in the form of vapour, or otherwise introduced into the system, paralyzes both the brain and the spinal cord, causing insensibility and loss of muscular power. Death from large doses occurs rapidly by syncope, due to arrest of the heart's action, or from smaller doses less rapidly by asphyxia, due to paralysis of respiration.

Symptoms.—These vary to a certain extent with the dose. Small poisonous doses cause a hot bitter taste, giddiness, pains in the head, and confusion of intellect, followed by insensibility and loss of muscular power. The eyes are bright and prominent, the face pale, and salivation is frequently present. The breathing often becomes stertorous, the breath smells of hydrocyanic acid, and in a very short time (see 'Fatal period') death takes place by asphyxia. Lock-jaw and tetanic convulsions, and involuntary expulsion of urine and fæces, often precede death. Vomiting has been observed, but is not a common symptom. Large poisonous doses cause almost immediate insensibility and rapid death from syncope. In rapidly fatal cases convulsions are not usually present, but there may be involuntary expulsion of urine and fæces. In cases of this class, death usually takes place with a forcible expiration, which may or may not be accompanied by a shriek. Some of the more important medico-legal questions which may arise in cases of poisoning by hydrocyanic acid are as follows:—

1. **Interval between swallowing the poison and insensibility.**—Large doses given to animals cause almost immediate insensibility. In man, the action of the poison appears to be less rapid: insensibility may, however, come on in a few seconds, and is rarely, if a full dose has been taken, delayed beyond the second minute. Still, however, even when a full dose has been swallowed, considerable power of volition and locomotion may remain, and various acts may be performed in the short interval between swallowing the poison and supervention of insensibility. Hence, finding the bottle out of which the poison has been taken corked, or even placed on a shelf or table close to, but out of reach of, the body, is consistent with a supposition of suicide. 2. As to the shriek.—This is not nearly so frequent a symptom of hydrocyanic acid poisoning in man as it is in the lower animals. What may be called the true hydrocyanic acid shriek accompanies the last forcible expiration; after such a shriek, power of speech, etc., no longer remains. 3. Presence of hydrocyanic acid in various articles of food.—*Amygdalin*, yielding hydrocyanic acid by its decomposition, is contained in the seeds, leaves, and flowers, and sometimes the bark, of most species of the sub-orders *Amygdalæ* and *Pomeæ* of the N.O. *Rosaceæ*. Its presence in the following may be specially noted: in bitter (but not in sweet) almonds, in apple and pear pips; in plum, damson, cherry, peach, apricot, and quince kernels; and also (apparently) in *loquat* seeds. The presence of hydrocyanic acid ready formed, in the root of the jatropha manihot, has already been mentioned (p. 559). It is estimated that 240 grains of bitter almond pulp, 333 grains of cherry kernels, and from about 1200 to 2200 grains of apple pips, are required to yield a quantity of hydrocyanic acid equal to 30 minims of the B.P. dilute acid.[1] *Kirschwasser*, a brandy distilled from wild cherries, contains hydrocyanic acid to the extent, it is said, of 1 to 4 grains in a pint. Hydrocyanic acid is also contained in chlorodyne (see p. 619).

Fatal period and dose.—Large doses have been found to

[1] Peach kernels contain rather less amygdalin than cherry kernels; plum kernels contain rather more amygdalin than apple pips.

kill the lower animals almost instantaneously. In man death occurs less rapidly, but has occurred as early as the second minute, and as late as one and a half hours after swallowing the poison. When the dose is 1½ drachms or more of the B.P. acid, the average fatal period is two to ten minutes. The smallest dose which has proved fatal to an adult is 0·9 grain of anhydrous acid, death occurring in twenty minutes; recovery has, however, taken place from 2·4 grains. One grain of the anhydrous acid may, but will not necessarily, prove fatal. In estimating the amount taken, it is important to recollect that drops and minims are not necessarily the same. Woodman and Tidy state that ten drops of hydrocyanic acid equal on an average 20 minims.[1] It may be further noted that dilution seems to make no difference to the action of the poison, but exhaustion from any cause, such as fatigue, favours its action; also that, although it has been asserted that hydrocyanic acid may act as a cumulative poison, the weight of evidence is greatly against its so acting. **Treatment.**—The best antidote is a mixture of a ferrous and ferric salt, with a little caustic soda or potash, or, if caustic alkali is not obtainable, with carbonate of soda. Inhalation of chlorine, *e.g.* from a mixture of chloride of lime and dilute acid held near the nostrils, is also useful. The other indications are to promote vomiting, to endeavour to restore sensibility by cold affusion and inhalation of weak ammonia, and to employ artificial respiration.

Post mortem signs.—These may be nil, but are generally similar to those of death from asphyxia. The odour of hydrocyanic acid is often, but not always, perceptible in the body, in the brain and muscles, as well as in the stomach. The smell of hydrocyanic acid has been detected in the stomach seven or eight days after death.

Tests.—Distil the viscera in a stream of carbolic acid gas. Heat gently, as the prussic acid is very volatile. Interrupt the distillation as soon as about 20 c.c. have come over. The receiver in which the distillate collects should be surrounded by ice.

The distillate should be tested for prussic acid as follows:—

(1) Make "*Schoenbein's* test paper" in the following way. Grind up a few grains of guiacum resin in a mortar. Add 10 c.c. of absolute alcohol and continue grinding until the guiacum is dissolved. Small strips of filter paper are then to be wetted with this solution. Allow them to dry. Wet a

[1] According to the same authorities, ten drops of chloroform or of tincture of opium equal five to six minims, and ten drops of the following tinctures equal six to eight minims:—aconite, digitalis, and hyoscyamus.

piece of this paper with 1 in 1000 copper sulphate solution. If it is then held over a liquid containing prussic acid or a cyanide the paper will turn blue. If the paper remains colourless a certain proof has been obtained that prussic acid is absent. If the paper turns blue, there is only a presumption that prussic acid is present, The paper is only sensitive when freshly prepared. It slowly turns blue if kept for a few days.

(2) *Berlin blue* reaction.—Add to a portion of the distillate a small quantity of pure caustic soda or potash. Add a drop of ferrous sulphate solution and a drop of a solution of ferric chloride. Warm gently just to the boiling point. Do not filter. Cautiously acidify with hydrochloric acid. In the presence of prussic acid or a cyanide a blue precipitate of Berlin blue is formed. If only traces of cyanides are present, the solution turns green, and blue floculi slowly deposit.

(3) The *Nitro-prusside* test. To a portion of the distillate add a few drops of potassium nitrate solution, and two to four drops of ferric chloride solution. A brownish-yellow colour is thereby produced. Add sufficient sulphuric acid to change this colour to pale yellow. Heat till the mixture begins to boil. Allow to cool. Add a few drops of ammonia. Filter and add to filtrate a drop or two of a very dilute and colourless solution of ammonium sulphide. If a cyanide is present a violet colour is produced. In a few minutes this changes successively to blue, green and yellow. If only very small quantities of cyanide are present the colour is at first bluish-green, soon passing to greenish-yellow. If traces of alcohol are present, as will be the case if the viscera have been preserved in alcohol, the colour at first produced will be yellow instead of violet (Hankin).

If analysis does not detect it, death may nevertheless have been due to poisoning by hydrocyanic acid. A case is recorded of death from hydrocyanic poisoning, in which analysis twenty-six hours after death failed to detect the poison. On the other hand, it has been detected by analysis seventeen, twenty-one, and even twenty-three days after death, and may be detected even if no odour of the acid is perceptible. Although analysis detects it, it may possibly be objected that the poison found (*a*) has been yielded by apple-pips, cherry-kernels, or the like, hence the contents of the stomach, vomited matter, etc., should always be carefully searched for such bodies, which, if found, should be separated before proceeding with the analysis ;

(*b*) Has been yielded by the decomposition of sulphocyanide of potassium present in the saliva ; this theory may account for the discovery of a minute trace of hydrocyanic acid, but not for more ;

(*c*) Has been produced by the action on organic matters of

the heat employed in distillation. A high temperature, much higher than that of a salt-water bath, would be required, however, to produce even traces in this way.

Case.—**Hydrocyanic acid poisoning—Suicidal.**—A Bengali Hindu, aged about 36, was found restless in his bed for a few minutes, and then expired Two empty phials which had contained hydrocyanic acid were found near the deceased. At the *post mortem* examination the stomach was found dilated and empty, the mucous membrane was deeply congested, and covered with thick, sanious-looking, tenacious mucus. No smell of hydrocyanic acid was detected in the stomach. The viscera were sent for chemical analysis by the Civil-Surgeon of the 24-Parganas, and hydrocyanic acid was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Case.—**Hydrocyanic acid—Theft and Murder.**—A case of murder by administration of hydrocyanic acid, attended with robbery, occurred in the town of Calcutta in October, 1906. A woman of the town was seen drinking with a stranger in her room one evening; shortly afterwards she was discovered by the other inmates of the house lying on the floor, but the stranger was not to be found anywhere. She was placed in her bed and expired soon after. The *post mortem* signs were consistent with death from heart failure. The chemical analysis of the viscera revealed the presence of hydrocyanic acid. The ornaments of the woman were missing. The murderer still remains undetected.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Essential oil of bitter almonds, *Benzoyl hydride,* or *Benzoic aldehyde,* is obtained by distillation of an emulsion of the cake left after expression of the fixed oil from bitter almonds. It is formed by the fermentative action of emulsion, present both in sweet and bitter almonds, on amygdalin, a glucoside present in the bitter, but not in the sweet, variety. During the decomposition, hydrocyanic acid is also produced, which, if not removed, renders the oil poisonous. Essential oil of bitter almonds unpurified, as generally sold, contains 8 to 15 per cent. of hydrocyanic acid. Seventeen drops of the unpurified oil has caused death in an adult, and probably less would prove fatal. Essential oil of bitter almonds is also sold under the name of peach-nut oil, and a fatal case is reported, arising from its having been sold by mistake for beechnut oil. Diluted with four to eight parts of rectified spirit, it forms the almond flavour or essence of the shops, sold for the purpose of flavouring confectionery. Bitter almond water, another preparation, contains hydrocyanic acid to the extent of 0·25 to 1·0 per cent. A fatal case of poisoning by bitter almonds in an adult female is also reported. The quantity taken was estimated at about 1200 grains. The symptoms, treatment, etc., in poisoning by essential oil of bitter almonds are the same as in poisoning by hydrocyanic acid. Hydrocyanic acid may be detected in it by the vapour tests, or by applying the tests for the acid to water

which has been shaken with the oil. The purified oil—from experiments on animals—acts as an intoxicant, but is very much less poisonous than the crude oil. **Water distilled** from the following also contain hydrocyanic acid derived from decomposition of amygdalin, or a substance allied to it: the leaves of the cherry laurel (*Prunus laurocerasus*); the flowers, bark, seeds and leaves of the mountain ash (*Sorbus aucuparia*); and the bark, seeds, and leaves of the cluster cherry (*Prunus padus*). One ounce of cherry laurel water has proved fatal to an adult, and in a celebrated case (murder of Sir T. Broughton, 1781) two ounces proved fatal in half an hour. The blossoms of the peach also have, from a similar case, in two cases caused death.

Cyanides of potassium, Sodium and Ammonium are all intensely poisonous. Cyanide of potassium, more commonly met with than the others, contains cyanogen equal to about 40 per cent. of hydrocyanic acid. It is largely used for various purposes in the arts, *e.g.* in cleaning gold and silver lace, plate, etc.; by photographers for removing silver stains; and by electro-platers, the ordinary electro-plating solution being silver cyanide dissolved in cyanide of potassium solution. Fatal cases have been reported from swallowing this solution as well as from swallowing cyanide of potassium; and serious symptoms have arisen from the absorption, through abrasions on the skin, of cyanide of potassium employed for the purpose of removing silver stains from the hands. Two and a half grains of pure potassium cyanide may be regarded as a minimum fatal dose. The commercial salt is, however, generally impure from the presence of potassium carbonate, produced by the action of the carbon dioxide of the air on the cyanide. In an exceptional case recovery took place after swallowing more than half an ounce of the commercial salt. The symptoms, etc., are the same as in poisoning by hydrocyanic acid. Probably, however, after death more evidence of irritation will be found.

Case.—**Cyanide poisoning—Corrosive action.**—A case, remarkable for the corrosive effects of the crude drug owing to contamination with carbonate and caustic potash, is reported by Dr. A. Powell. The angles of the lips, the mucosa of the tongue, cheeks, pharynx, and œsophagus were whitened, feeling soapy to the touch. The mucosa of the stomach was dissolved, leaving a red, raw surface. On section the epithelium was found to have disappeared except from the bottom of a few follicles. The autopsy was made four hours after death. Several witnesses deposed that death took place between seven and twelve minutes after swallowing the poison.—*Ind. Med. Gaz.*, 1902, p. 306.

Cases.—**Prussic acid poisoning by cyanides—Suicidal.**—(*a*) A respectable-looking Bengali Hindu, aged about 23 years, was found dead on a bench in the Eden Gardens, Calcutta, on the 11th July, 1899. A bottle

containing cyanide of potassium was found tied in his chaddar. In his right hand were found three lumps of potassium cyanide; a reddish froth was issuing from his mouth. In the pocket of his coat was found a tram ticket for the Chitpore car. Some prepared betel, a knife, and a slice of ripe mango were found close to the dead body. The body could not be identified. The viscera were forwarded for chemical examination, and prussic acid was discovered in them. It is evident that the man went to the Eden Gardens to commit suicide by taking cyanide of potassium. Cyanide of potassium is freely sold in shops in the bazaar without any restrictions. (*b*) In another fatal case, in 1899, a gilder committed suicide by drinking some silverising solution (cyanide of silver dissolved in cyanide of potassium).—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case.—**Cyanide of potassium—Suicide.**—A European assistant in a firm in Calcutta, aged about 40 years, was found lying dead across his bed. The *post mortem* examination revealed the presence of intense congestion of the mucous membrane of the stomach and duodenum; all the other internal organs were also congested. The stomach contained about five ounces of a watery fluid smelling of hydrocyanic acid. Cyanide of potassium was detected in the viscera.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1911.

Case.—**Homicidal cyanide poisoning with John Hunter as medical witness.**—G. V. Poore, in the *Clinical Journal* of August 23, 1899, discusses cyanide poisoning, and cites the case of the *King* v. *Donellan*. The case is especially interesting, as the celebrated John Hunter made his appearance upon the witness-stand in that case. In 1780 Captain Donellan was put upon trial for the murder of his brother-in-law, Sir Theodosius Boughton. Donellan and Boughton lived in the same house, and it was known that the former would benefit pecuniarily by the death of the latter. An apothecary had prescribed for Boughton, and the draught, which was supposed to be a purge, was administered by the mother of the deceased, though she noticed when administering it that it smelled of bitter almonds. Boughton died half an hour after taking it in convulsions. Donellan emptied and rinsed out the bowl which had contained the draught. Captain Donellan had a chemical 'still' in his room, which he had given to a servant to clean a few days previously, it having been recently used. The medicine which had been administered by the apothecary contained no oil of bitter almonds. The body of Boughton was exhumed, and evidences of congestion were found. Hunter was called as a witness. He testified that the *post mortem* signs were all due to putrefaction, and that death might have been due to apoplexy; the head not having been opened, it was impossible to say whether this was so or not. Being asked in cross-examination whether the fact of a man in perfect health, dying in convulsion immediately after swallowing a draught, did not point to poison, he replied, "If I knew the draught were poison, I should say most probably that the symptoms arose from that; but when I do not know that the draught was poison—when I consider that a number of other things might occasion his death—I cannot answer positively to it." Hunter admitted that it was not very probable that Sir Theodosius Boughton died of apoplexy. The final question asked by the Court was: "Give me your opinion in the best way you can, one way or the other, whether, upon the whole of the symptoms described, death proceeded from that medicine or from any other cause:" to which Hunter answered: "I do not mean to equivocate, but when I tell the sentiments of my own mind—what I feel at the time—I can give nothing decisive." The judge made

the following comment on the testimony of Mr. Hunter: "For the prisoner you have had one gentleman called; he is likewise of the faculty, and a very able man. I can hardly say what his opinion is, for he does not seem to have formed any opinion at all of the matter. He, at first, said he could not form an opinion whether the death was or was not occasioned by the poison, because he could conceive that it might be ascribed to other causes. I wished very much to have got a direct answer from Mr. Hunter, if I could, what upon the whole was the result of his attention and application to the subject, and what was his present opinion, but he says he could say nothing decisive. So that, upon this point, if you are to determine upon the evidence of the gentlemen who are skilled in the faculty only, you have the very positive opinion of four or five gentlemen of the faculty that the deceased died of poison. On the other hand, you have what I really cannot myself call more than the doubt of another; for it was agreed by Mr. Hunter that the laurel-water would produce the symptoms which are described. He says an epilepsy or an apoplexy would produce the same symptoms, but as to apoplexy, it is not likely to attack so young and so thin a man as Sir Theodosius was; and as to epilepsy the other witnesses tell you that they do not think the symptoms which have been spoken of do show that Sir Theodosius had any epilepsy at the time." The jury brought in a verdict of guilty, and Captain Donellan was executed a few days thereafter. A remarkable circumstance which came to light afterwards was that a still that had been recently used was discovered on the premises. Donellan was so bad a chemist that on being asked for what purpose he had procured this machine, he replied: "I used it to make lime-water to kill flies." In his laboratory there was found a single number of the *Philosophical Transactions*, and of this volume the leaves had been cut in only one place, which opened to an account of the mode for making laurel-water by distillation. John Hunter, in the opinion of Poore, made a phenomenally bad witness, yet he says that one cannot help agreeing with many of the doubts that Hunter raised in this case.

Mercuric cyanide.—This, already mentioned as a poisonous mercuric salt, according to some authorities, acts like hydrocyanic acid. Silver cyanide also, from experiments on animals, appears to act like hydrocyanic acid, but is much weaker; it contains cyanogen equal to about $\frac{1}{5}$th of its weight of hydrocyanic acid. A case of attempted suicide by swallowing cyanide of silver, in which recovery took place under prompt treatment, occurred near Poona a few years ago.

Case.—**Homicidal cyanide poisoning by post.**—Several cases of cyanide poisoning by the post occurred in New York in 1888. In one of these, H C. Barnet, whose death was deliberately planned, did not die until after ten days' illness.—*Medicine*, February, 1889, p. 174.

Potassium ferrocyanide.—Yellow prussiate of potash under ordinary circumstances, is either not poisonous or only very feebly poisonous. When acted on by acids, however, it yields HCy. In one case, death resulted from swallowing a dose of this salt, followed by one of tartaric acid; and in another, from swallowing a dose of the salt, followed by a mixture of nitric and hydrochloric acids. Other ferrocyanides probably act

similarly to potassium ferrocyanide. Potassium sulphocyanide is poisonous, but not very active. The cyanates (from cyanic acid, HCNO) are asserted to be non-poisonous. Cyanuric acid, however, Blyth states, causes symptoms and effects similar to those produced by hydrocyanic acid.

Other cardiac poisons.—In addition to the foregoing the following vegetable irritants already described appear to possess an action on the heart similar to those possessed by digitalin : Scillitin, the active principle of squill, and probably also superbine, from *Gloriosa superba*. Helleborein, from *Helleborus niger* and *H. viride*. Anemonin, from *Anemone pulsatilla*, etc., and Adonidin, from *Adonis vernalis*.

An action on the heart similar to that of digitalin appears also to be possessed by the following: Antiarin, a glucoside contained in *Antiaris toxicaria*, a native of Java, where the milky juice of the plant is used as an arrow poison. Strophantin, a poisonous principle contained in *Strophantus hispidus*, N.O. *Apocynaceæ*.—Apocynin, a poisonous principle contained in the root of *Apocynum cannabinum*. Erythrophleine, an alkaloid obtained from the bark *Erythrophlœum guineense*, a native of West Africa. Euonymin, a glucoside contained in *Euonymus atropurpureus*: and by Tanghinia venenifera, or Madagascar ordeal poison. Saponin and several vegetable irritants appear to possess an action on the heart similar to that possessed by digitonin.

Asphyxiants.

Carbon dioxide, carbonic acid gas.—The gas is a product of respiration, combustion, and fermentation, and of the decomposition of organic matter. It is also evolved during the decomposition of carbonates by heat, as in lime-burning ; or by acids, as in the chemical preparation of the gas. Poisoning by carbon dioxide is usually accidental. In some countries, however, *e.g.* France, exposure to the fumes arising from a pan of burning charcoal placed in a room, the door, windows, etc., of which have been tightly closed, is a favourite method of committing suicide. (See also ' Carbon monoxide.')

Accidental cases may arise from the carbon dioxide disengaged in any of the ways mentioned above. For example, from carbon dioxide evolved as a product of (1) Respiration, as when they occur in consequence of a number of persons sleeping in a small, badly ventilated room. (2) Combustion, in a similar way to the suicidal cases mentioned above. Accidental

cases of this kind have occurred in India (see *Case* (*a*) below). Under this head also come cases of poisoning by 'choke damp,' or carbon dioxide, formed as a product of coal-mine explosion. (3) Fermentation; carbon dioxide, evolved in this way is liable to accumulate in vats, in which fermentation has been conducted, *e.g.* brewers' vats rendering descent into the vat, in order to clean it, dangerous to life. (4) Decomposition of organic matter. Carbon dioxide thus produced is liable to collect in old wells, pits, vaults, etc., and to give rise to accidents. Descending into pits used for storing grain, which have been closed for some time, may result in death from carbon dioxide poisoning. A case of this kind occurred in 1888, in the hold of a ship at Calcutta (see *Case* (*a*)). (5) Decomposition of carbonates. Persons sleeping close to a lime-kiln have died of carbon dioxide poisoning; and Taylor mentions a case of accidental poisoning, arising from the use of chalk to neutralize a quantity of nitric acid which by accident had leaked into a room.

Cases.—**Accidental poisoning by Carbon Dioxide.**—(*a*) Dr. Moffat reports that four men were brought one morning to the dispensary at Naini Tal in a state of insensibility. They had been found in a closed room 6 × 8 × 7 feet, with a pan of charcoal between them. The previous night had been a very cold one. Of the four one never recovered sensibility, and died shortly after admission. The other three are described as being, soon after admission, in a drowsy, semi conscious state; when shaken and spoken loudly to, they could be made to sit up and answer questions. Their eyes had a filmy look, the pupils were dilated, the pulse small and weak. Two of the three recovered completely; the third was attacked with œdematous erysipelas, and died four days after admission.—*Ind. Med. Gaz.*, 1877, p. 184. (*b*) A very similar case, in which five persons were poisoned, of whom one died, occurred at Nowshera.—See *ib.*, March, 1885.

Cases.—**Poisoning by gases from decomposing grain.**—(*a*) In 1888 thirteen men were poisoned by gas in the hold of the steamer *Clan McIntosh* at Calcutta. A few days before the catastrophe a lot of fodder (hay) which had been kept on deck in one of the sheep-pens was, owing to heavy weather, put into the lower storeroom, which also contained some bags of grain, paddy, gram, barley, etc. This fodder may have got wet before it was removed below; but there was no evidence to show whether these articles had actually become damp, because the lower storeroom was flooded with water after the bodies had been recovered. There was no leak into the storeroom, but a leak was discovered close by, and one of the witnesses thought it possible that leakage may have taken place into the room. An unpleasant smell of "bilge" was observed about the place for a few days previous to the accident, and this was traced to the ventilators of the upper storeroom. It was probably this smell that induced the chief steward, accompanied by three firemen, to visit the lower storeroom. They were observed to fall down, and several of the officers and crew promptly descended into the hatchway for the purpose of bringing them up. The light which they carried went out, and they speedily became insensible. Of thirteen persons who entered the lower storeroom eight revived on being brought on deck. The

remaining five bodies were not recovered for two hours and a half, and when they were, life was extinct. The surgeon of the ship was in attendance, and rendered every aid in his power. He deposed that the five men died of asphyxia, and that the eight who recovered suffered from symptoms of asphyxia. He thought this was due to a mixture of carburetted hydrogen gas and carbonic oxide. (*b*) (*Ind. Med. Gaz.* for 1874, p. 295).—Dr. Gardner, of Saharunpur, reports a case in which three men died shortly after descending into a pit used for the purpose of storing grain. The pit had just been opened, but instead of, as is customary, leaving it open for some time before allowing any one to descend, the owner, being afraid of rain, sent his servants, four in number, down at once. The fourth man was also attacked, but recovered. The *post mortem* appearances in the three fatal cases were those of death from apnœa, with numerous sub-plural ecchymoses, of a dark purple colour.

Symptoms.—When undiluted, carbon dioxide causes spasm of the glottis and death from apnœa; diluted, it appears to act as a narcotic poison,[1] causing narcotism, followed by coma and death. The more the gas is diluted, the more gradually it produces its effects. If much diluted, there is at first headache, giddiness, and singing in the ears, gradual loss of muscular power. Usually the face is livid, and there is palpitation, and hurried respiration. Gradually narcotism supervenes, deepening into coma with stertorous breathing. Sometimes vomiting and convulsions are present.

Toxic percentage.—Considerable difference of opinion exists on the question, what percentage of carbon dioxide present in air may be considered to render it poisonous? When carbon dioxide is simply added to air containing its normal percentage of oxygen, probably eight to ten per cent.—some say more—would be required. When developed at the expense of the oxygen of the air by respiration, probably five per cent. would suffice; very much less than this would probably cause distress in most persons, and two per cent., it is stated, occasions severe suffering. When developed at the expense of the oxygen of the air by combustion, carbon monoxide is usually at the same time formed, which, being more poisonous than carbon dioxide, augments the toxic action of air vitiated in this way. It is very important to note that a candle will continue to burn in air containing a poisonous percentage of carbon dioxide.

Post mortem signs.—The face may be pale or livid and swollen. The tongue is often protruded and grasped by the teeth; sometimes there is froth at the mouth and nostrils.

[1] It is alleged by some that carbon dioxide is not poisonous, and that its apparently poisonous action on animals is simply due to their being deprived of oxygen.

Internally, the appearances are similar to those of death by apnœa. Usually there is much congestion of the brain and its membranes, and of the abdominal viscera.

Treatment.—Remove the patient at once into pure air. Endeavour to restore sensibility by cold affusion and galvanism. Employ artificial respiration, and if there is much congestion, moderate bleeding may be resorted to. Obviously, if a person on descending into a pit or vat is seen to fall immediately insensible from poisoning by carbon dioxide, to allow others to descend to his rescue is apt to lead only to a useless waste of life. Taylor cites a case where two men lost their lives in this way in attempting to rescue a boy who had fallen into a brewer's vat. Before persons are allowed to descend, the carbon dioxide should be chased out by driving fresh air into the pit or vat; or lime may be thrown down to absorb the gas.

Quantitative poisoning.—This may be effected by filling a large narrow-necked vessel of known capacity with the air to be examined, and adding a measured quantity of lime-water, the alkalinity of which has been first ascertained by a standard solution of oxalic acid. The vessel is then tightly closed, well shaken, and allowed to remain at rest for twenty-four hours. After this, the bottle is opened, the fluid poured out, a measured quantity (say equal to half the volume of the fluid originally poured into the bottle) separated; and the loss of alkalinity ascertained by titration as before, with standard oxalic acid solution. The loss of alkalinity of the whole fluid corresponds to the amount of lime converted into carbonate by the carbon dioxide contained in a quantity of the air under examination, equal to the capacity of the vessel, minus the volume of lime-water used. The quantity of carbon dioxide likely to be present in an enclosed space, *e.g.* a room, in which the air has been vitiated by respiration or combustion, may be approximately estimated from the following data. Normal air contains on an average four volumes of carbon dioxide per 10,000 of air. Each adult may be considered to give out from a half to six-tenths of a cubic foot of carbon dioxide per hour.[1] A candle or small lamp gives off about half a cubic foot per hour. If charcoal has been burnt in the room, the amount of carbon dioxide[2] evolved may be approximately inferred from the weight of the residual ash. Roughly, one pound of charcoal corresponds to twenty-nine cubic feet of carbon dioxide, and leaves about half an ounce of ash. Carbon dioxide is about half as heavy again as air of the same temperature. Like other gases, it expands and becomes lighter as the temperature rises. Gases, however, diffuse into one another, even against gravity. Hence, for a certain time after it has been evolved, hot carbon dioxide will be found in greatest quantity in the upper, and cold carbon dioxide in the lower strata of a confined portion of air. After a time, however, the gas will have become uniformly distributed by diffusion. After this has taken place, separation by gravity does not occur.

Carbon Monoxide, or Carbonic Oxide.—*Carbon monoxide*

[1] As the air gets vitiated the amount given out per hour decreases a little.

[2] A portion of the carbon, however, will probably have become converted into carbon monoxide, which is more poisonous than carbon dioxide.

is obtainable by passing carbon dioxide over red-hot charcoal. A certain quantity of it is always formed during the combustion, under ordinary conditions, of charcoal or other carbonaceous fuel, the amount being greatest when the combustion is least active, and *vice versâ*. It is a powerful narcotic poison, much more powerful than carbon dioxide. Death from inhalation of the products of combustion, *e.g.* the fumes of burning charcoal, is probably in many cases due to carbon monoxide poisoning. After death from poisoning by carbon monoxide, the blood is found bright red in colour, not darkened, as in carbon dioxide poisoning. This is held to be due to the carbon monoxide forming, with the hæmoglobin of the blood, a compound of a red colour (carbonic oxide hæmoglobin). It is asserted by some that this compound is so stable that it cannot be broken up by simple exposure to air or oxygen; and hence, that in poisoning by carbon monoxide, artificial respiration is useless, and transfusion of arterial blood the only remedy. Others deny this, and hold that the compound does break up on exposure of the blood to air.

Case.—**Carbon monoxide poisoning.**—In the year 1908, when the Alexandra Docks were being built in Bombay, a stack of several hundred tons of coal caught fire. To extinguish the fire earth was thrown on the top of the coal, and water continually poured on. As a result of these measures the coal slowly smouldered under the covering of earth which shut off the oxygen necessary for active combustion. Twenty-three of a gang of coolies engaged in carrying the earth became first lethargic, and then lay down at the foot of the stack and became unconscious. A European foreman, who recognized the symptoms, carried the coolies to a distance, finally being himself overcome. Seven of the twenty-three died. *Post mortem.*—I found them all of a bright red colour in patches. The blood of all was of the characteristic cherry-red colour, and gave the characteristic spectrum.—Prof. A. Powell, *Notes*, 1917.

Coal gas.—The escape of this gas into badly ventilated rooms has frequently given rise to narcotic poisoning. The chief (according to some, the only) poisonous constituent of coal gas is carbon monoxide. The quantity of carbon monoxide present varies in different specimens. Usually the amount present is 5 to 11 per cent., but as much as 22 per cent. has, it is stated, been found. The constituent usually present in largest quantity in coal gas is methane or light carburetted hydrogen (40 to 45 per cent. or more). Methane, even when present in air in quantity sufficient to form an explosive mixture (5½ per cent. or over), appears to exert little or no toxic action. Its presence in air, however, is a source of danger to life from the risk of an explosion, which may cause mechanical injury or result in poisoning by carbon dioxide.

Sewer gas may contain, in place of sulphuretted hydrogen, the vapour of hydrosulphide of ammonium, which appears to be equally poisonous. Or again, sewer gas may only contain sulphuretted hydrogen in small quantity, and but little carbon dioxide, but still produce asphyxia in those breathing it, owing to its consisting almost wholly of nitrogen, *i.e.* of deoxidized air.

Sulphuretted Hydrogen, H_2S.—The decomposition of organic matter may result in the production of this gas, directly, when the matter undergoing decomposition contains sulphur, indirectly, when the decomposition takes place in presence of a soluble sulphate. In the latter case the sulphate yields a sulphide which, when acted on by carbonic or other acids, evolves H_2S. Accidental poisoning by sulphuretted hydrogen is liable, therefore, to occur from exposure to the emanations from decomposing organic matter, *e.g.* in cesspools or sewers. This liability is increased, if an acid liquid finds its way into the sewer. It was to this Dr. Lethby attributed the accident in the Fleet Lane sewer in February, 1861. Agitation, also, of the liquid in the sewer, etc., favours the evolution of the gas. Symptoms.—When concentrated, it causes immediate death. When dilute, it gives rise to nausea and the usual symptoms of narcotic poisoning, *e.g.* headache, giddiness, and laboured respiration, followed by coma. Sometimes delirium and tetanic convulsions are present. When very much diluted, the symptoms are chiefly nausea and abdominal pain, with febrile disturbance.—*Post mortem* signs.—The body exhales an offensive odour, putrefaction is rapid, and the blood is fluid and dark-coloured; there is a general congestion of the viscera, and engorgement of the right side of the heart. Woodman and Tidy lay stress on the presence of a dirty brown deposit smeared over the lining membrane of the bronchial tubes, as characteristic of death from sulphuretted hydrogen. Treatment.—Immediate removal into pure air, cold affusions, stimulants, and inhalation, as an antidote, of dilute chlorine, as in hydrocyanic poisoning. Detection.—Free sulphuretted hydrogen is readily recognized by its characteristic odour of rotten eggs, and by its blackening paper moistened with solution of lead acetate. Sulphides—those of the heavy metals excepted—are decomposed by dilute acids, sulphuretted hydrogen being set free.

Nitrous Oxide or Laughing gas.—This is used as an anæsthetic instead of chloroform, and has caused several deaths. Death from inhalation of laughing gas appears to be due to asphyxia; indeed, it has been asserted that the anæsthetic effect of the gas is due to the production of temporary asphyxia, owing to the circulation of non-oxygenated blood, the blood having no power to separate the oxygen contained in this gas.[1]

Carbon Disulphide, Bisulphide of Carbon, CS_2.—This liquid, owing to its solvent action on sulphur, caoutchouc, ordinary phosphorus, and other substances, is largely used in certain industries. The vapour of carbon disulphide, from experiments on animals, has been shown to be a narcotic poison, acting very similarly to chloroform. Cases of chronic poisoning by carbon disulphide vapour have been observed among the work-people in factories where the liquid is largely used. The symptoms observed in these cases have been a stage of excitement, followed by one of depression. The first stage begins with headache, indigestion and nausea, and

[1] Joylet and Blanche, quoted by Taylor, *Manual*, p. 445.

creeping sensations, followed by irritability and excitement of the nervous system, which may terminate in mania. In the second stage there is anæsthesia of the skin and mucous membranes, mental debility, and muscular weakness which may culminate in paralysis. The "Poison-gas" deliberately introduced by the Germans for war purposes in 1914 is said to consist mainly of nitric oxide and chlorinic fumes.

Peripheral Poisons.

These especially act on the motor nerve terminals end-plates. There is no recorded instance of poisoning by them in India except by cocaine, see p. 631.

Conium.—*Conium maculatum*, or Spotted Hemlock, N.O. *Umbelliferæ; Showkran* (Arab.), *Kirdamana* (Bo.).—This is a common plant in Europe and temperate Asia. The whole plant has a 'mousey' fœtid odour and is poisonous, the leaves and fruit are officinal B.P. and I.P. It was the Athenian State-poison by which Socrates died. Cases of poisoning by conium are somewhat rare.

Falck[1] found seventeen recorded in medical literature, of which fourteen were accidental, chiefly from the plant being mistaken for parsley or some other harmless herb. One case is recorded of a child, who died, poisoned by conium, from blowing whistles made of conium twigs. Conium contains a poisonous liquid alkaloid, *conia*, and a less poisonous crystalline alkaloid, *conhydrine*. These are similar in action, paralysing first the peripheral extremities of the motor nerves, and subsequently their trunks. In addition, commercial conia has been found to contain a variable quantity of *methyl-conia*, a liquid volatile alkaloid, which paralyses the cord. **Identification.**—The stem of the plant is described by Guy as tall, smooth, glossy green, and dotted with brownish purple spots. The root is tapering, and in shape something like a parsnip, for which it has been mistaken. The leaves are deep green, and have often been mistaken for parsley leaves, from which, however, they differ greatly in shape. According to the Pharmacographia, the fruit, as met with in the shops, "consists of the separated mericarps, which are about one-eighth of an inch long. The dorsal surface of these have five prominent longitudinal ridges, the edges of which are marked with little protuberances, giving them a jagged or crenate outline. . . . The furrows are glabrous, but slightly wrinkled longitudinally; they are devoid of vittæ." The absence of vittæ distinguishes hemlock fruits from other fruits of the same N.O. All parts of the plant, when bruised and moistened with potassic hydrate solution, give out a peculiar mousey odour. **Action.**—The prominent symptoms of conium poisoning are muscular weakness with loss of power to swallow, the weakness deepening into complete paralysis, affecting the extremities first, and afterwards the trunk. The pupils are dilated, there is ptosis, and sometimes convulsive twitchings. Consciousness remains until asphyxia sets in. Death occurs rapidly, by asphyxia due to paralysis of respiration, usually in one to four hours. The medicinal dose of the powdered leaves is two to eight grains, and of the tincture of the fruit—strength 1 to 8—

[1] Blyth, *Poisons*, p. 253.

20 to 60 minims. According to Woodman and Tidy, one drop of the alkaloid conia may be regarded as a poisonous dose. **Treatment.**—General, as for spinal poisons. **Post mortem.**—As in death by apnœa.

Conine may be separated from organic mixtures by Stas' process, using petroleum ether as a solvent, and conducting all evaporations, etc., at a low temperature. It is recognized by its peculiar mousey-like odour and its action on animals. Schwarzenbach[1] gives the following colour test for conia: "If dropped into a solution of alloxan, the latter is coloured after a few minutes, and intense purple red and white needle-shaped crystals are separated, which dissolve in cold potash-lye into a beautiful purple blue." Conia coagulates albumen, and gives an amorphous precipitate with mercuric chloride solution: these characters distinguish it chemically from nicotine (see p. 673).

Curari, or **Wourali.**—This substance, also called *Urari* or *Tikunas,* is a black resinoid mass, almost wholly soluble in water, used by the South American Indians as an arrow-poison. It is believed to be an extract from a species of *Strychnos,* probably *S. toxifera,* mixed with other matters. When swallowed, it usually causes no symptoms of poisoning. Introduced into a wound, it acts like conia, paralysing the motor nerves, and causing death by paralysis of respiration. It contains an alkaloid, curarine, sparingly soluble in chloroform, and giving a purple colour with strong nitric acid.

Curari was one of the poisons arranged to be used in a fanatical plot to poison the Prime Minister, Lloyd George, in 1917, and the intention was to smear it over a protruding nail in the sole of his boot—to act like a serpent's tooth in introducing the poison hypodermically.

The following alkaloids are similar in action to conia and curari:—Sparteine, a liquid volatile alkaloid, contained in common broom Staphisagrine, one of the alkaloids contained in stavesacre (see p. 549), and Methyl-strychnia, Methyl-brucia, and Methyl-thebaia, alkaloids obtained from respectively strychnia, brucia, and thebaia, by the substitution of methyl for hydrogen. It may be noted that this substitution, in the case of the alkaloids just mentioned, converts central into peripheral spinal poisons. In the case of conia, a similar substitution converts a peripheral into central spinal poison (see Methyl-conia, pp. 672 and 711).

The Somalis on the East Coast of Africa prepare for hunting and war a paralysing arrow-poison from the extract of the root of '*Oubain,*' a tree allied to the *Carissa schimperi.* The term would seem to be used perhaps in a general sense, for one form of *Oubain* brought from the Harmassia country by Dr. Macpherson consisted of an extract from the wood and leaves of *Acokazthera schimperi,* and it also proved to be a most virulent paralysing poison of the motor nerve-terminals, like that obtained from an altogether different genus.

[1] Blyth, *Poisons,* p. 251.

APPENDICES.

I.

QUESTIONS FOR MEDICAL WITNESSES.

(From Departmental Circulars of 1st February, 1864; 4th March, 1892.)

When a case arises requiring medical opinion, the police officer should forward the subject to the medical officer,[1] with such a general description of what is known of the case that the attention of the medical officer may be turned in the right direction. A printed form is provided for the purpose, and should always be used. The reference may be made in English or in the vernacular, as the case may be.

2. The result of the medical officer's examination, together with his opinion on the case, will be entered in that part of the printed form provided for the purpose, and the form so filled up will be returned to the police.

3. The police officer, having received the report of the medical officer, will send up the case according to rule to the magistrate, sending with the *chalan* the form containing the reference to the medical officer and his reply thereto. On the list of witnesses will appear the name of the medical officer.

4. The only use of the medical officer's report will be to assist the police in getting up the case, to refresh the memory of the medical officer at the time of giving his deposition, and to aid the judicial officer in framing his queries. It cannot be admitted as evidence (except under clause (2), *s.* 32 of the Evidence Act); nor is it sufficient to read it over to the medical officer and swear him to the truth of it; his deposition must be recorded *de novo* and at length in the presence of the accused.

[1] Circular 55.—Where a *post mortem* examination is necessary, the corpse will be forwarded to the nearest civil surgeon or other medical officer appointed in this behalf by the Local Government under *s.* 174, Code of Criminal Procedure.

The magistrate should therefore look into the case and make himself acquainted with its particular features before the medical officer enters the court, in order that the proper questions may be asked.

5. Care should always be taken to record the medical evidence so fully and intelligently as to render a second examination of the witness by another court unnecessary.

6. With a view of assisting magistrates in the task of asking suitable questions, a list of questions which suggest themselves in each class of cases is appended, to which the magistrate can refer at the time of the examination.

7. Before the medical officer leaves the court his deposition is to be fully interpreted to the accused, who is to be allowed to cross-examine. In order to ensure that the medical officer's deposition may in all cases be admissible under *s.* 509, Criminal Procedure Code, the magistrate must sign at the foot of it a certificate in the following form:—

> "The foregoing deposition was taken in the presence of the accused, who had an opportunity of cross-examining the witness. The deposition was explained to the accused, and was attested by me in his presence."

This is, of course, specially necessary when the deposition is taken in an inquiry preparatory to commitment to the sessions.

8. Whenever a medical officer is examined as to the result of his examination of any person, corpse or substance, evidence should always be taken to prove that the person, corpse, or substance examined by him, and to the examination of which he testifies, is the person, corpse, or substance in question in the case.

9. For this purpose the evidence of the persons conveying the corpse or substance to the medical officer should be taken; and in cases where the examination by the medical officer of a living person is in question, the identity of the person examined by him with the person in question in the case should be placed beyond doubt by actual identification in court if the person is able to be present, and if not, by the evidence of the person who conducted him to the medical officer.

10. If in any particular case the evidence of a medical witness is not to be had, the details, such as fact of death, symptoms, appearances, wounds, must be made out as correctly as possible from the evidence of non-professional eye-witnesses. The courts cannot assume any such facts from mere reports, not admissible as evidence. Police officers can always be put into the witness box to bear witness to what they saw.

A.

Questions which may be put to a **medical** witness in a fatal case of suspected **Poisoning**, after *post mortem* examination of the body.

1. Did you examine the body of ——, late a resident of ——, and, if so, what did you observe ?
2. What do you consider to have been the cause of death ? State your reasons.
3. Did you find any external marks of violence on the body ? If so, describe them.
4. Did you observe any unusual appearances on further examination of the body ? If so, describe them.
5. To what do you attribute those appearances—to disease, poison, or other cause ?
6. If to poison, then to what class of poisons ?
7. Have you formed an opinion as to what particular poison was used ?
8. Did you find any morbid appearances in the body besides those which are usually found in cases of poisoning by —— ? If so, describe them.
9. Do you know of any disease in which the *post mortem* appearances resemble those which you observed in this case ?
10. In what respect do the *post mortem* appearances of that disease differ from those which you observed in the present case ?
11. What are the symptoms of that disease in the living ?
12. Are there any *post mortem* appearances usual in cases of poisoning by ——, but which you did not discover in this instance ?
13. Might not the appearances you mention have been the result of spontaneous changes in the stomach after death ?
14. Was the state of the stomach and bowel compatible or incompatible with vomiting and purging ?
15. What are the usual symptoms of poisoning by —— ?
16. What is the usual interval between the time of taking the poison and the commencement of the symptoms ?
17. In what time does —— generally prove fatal ?
18. Did you send the contents of the stomach and bowels (or other matters) to the chemical examiner ?
19. Were the contents of the stomach (or other matters) sealed up in your presence immediately on removal from the body ?

20. Describe the vessel in which they were sealed up; and what impression did the seal bear?

21. Have you received a reply from the chemical examiner? If so, is the report now produced that which you received?

22. (If a female adult). What was the state of the uterus?

B.

Questions that may be put to non-professional witnesses in a Case of **Suspected Poisoning.**

1. Did you know ——, late a resident of ——? If so, did you see him during his last illness and previously?

2. What were the symptoms from which he suffered?

3. Was he in good health previous to the attack?

4. Did the symptoms appear suddenly?

5. What was the interval between the last time of eating or drinking and the commencement of the symptoms?

(If death occurred.) 6. What was the interval between the commencement of the symptoms and death?

7. What did the last meal consist of?

8. Did any one partake of this meal with ——?

9. Were any of them affected in the same way?

10. Had —— ever suffered from a similar attack before?

If any of the following symptoms have been omitted in answer to question 1, special questions may be asked regarding them as follows.

11. Did vomiting occur?

12. Was there any purging?

13. Was there any pain in the stomach?

14. Was —— very thirsty?

15. Did he become faint?

16. Did he complain of headache or giddiness?

17. Did he appear to have lost the use of his limbs?

18. Did he sleep heavily?

19. Had he any delirium?

20. Did convulsions occur?

21. Did he complain of any peculiar taste in the mouth?

22. Did he notice any peculiar taste in his food or water?

This is with reference to Nux Vomica. 23. Was he sensible in the intervals between the convulsions?

This is with reference to Aconite. 24. Did he complain of burning or tingling in the mouth and throat, or of numbness and tingling in the limbs?

C.

Questions which may be put to a medical witness in a case of supposed **Death by Wounds or Blows** after *post mortem* examination of the body.

1. Did you examine the body of ——, late a resident in the ——, and if so, what did you observe?
2. What do you consider to have been the cause of death? State your reasons.
3. Did you find any external marks of violence on the body? If so, describe them.
4. Are you of opinion that these injuries were inflicted before or after death? Give your reasons.
5. Did you examine the body internally? Describe any unnatural appearance which you observed.
6. You say that in your opinion —— was the cause of death; in what immediate way did it prove fatal?
7. Did you find any appearance of disease in the body?
8. If so, do you consider that if the deceased had been free from this disease the injuries would still have proved fatal?
9. Do you believe that the fact of his suffering from this disease lessened his chance of recovery from the injuries sustained?
10. Are these injuries taken collectively (or is any one of them) ordinarily and directly dangerous to life?
11. Have they been caused by manual force or with a weapon?
12. Did you find any foreign body or foreign matter in the wound?
13. By what sort of weapon has the wound been inflicted?
14. Could the injuries have been inflicted by the weapon now before you (No. —— Article in evidence)?
15. Could the deceased have walked (*so* far) or spoken, &c., after the receipt of such an injury?
16. Have you chemically or otherwise examined the stains (on the weapon, clothes, &c.) now before you (No. —— Article in Evidence)?
17. Do you believe the stains to be those of blood?
18. What time do you think elapsed between the receipt of the injuries and death?
19. What was the direction of the wound, and can you form an opinion as to the position of the person inflicting such a wound with respect to the person receiving it?

20. Is it possible for such a wound to have been inflicted by any one on his own person?

(In gunshot wounds.) 21. Give the precise direction of the wound.

22. Did the appearances of the wound indicate that the gun had been discharged close to the body or at some distance from it?

23. Did you find any slug, bullet, wadding, &c., in the wound or had —— made its exit?

24. Do you think it possible that you could have mistaken the aperture of entrance for that of exit?

D.

Questions that may be put to a medical witness in a case of supposed **Infanticide,** after *post mortem* examination of the body.

1. Did you examine the body of a $\frac{\text{male}}{\text{female}}$ child sent to you by the District Superintendent of Police on the ——of——19 , and if so what did you observe?

2. Can you state whether the child was completely born alive, partially born alive, or born dead? State the reasons for your opinion.

3. What do you consider to have been the cause of death? Give your reasons.

4. What do you believe to have been the uterine age of the child? State your reasons.

5. What do you believe to have been the extra-uterine age of the child? Give reasons.

6. Did you find any marks of violence or other unusual appearances externally? If so, describe them accurately.

7. Did you find any morbid or unusual appearances on examination of the body internally? If so, describe them accurately.

8. Do you believe the injuries you observed to have been inflicted before or after death? Give reasons.

9. Can you state how they were inflicted? Give reasons.

10. Do you consider that they were accidental or not? Give reasons.

11. Had the infant respired fully, partially, or not at all?

12. Did you examine the person of ——, the alleged mother of the infant? If so, have you reason to suppose that she was recently delivered of a child? Can you state approximately the date of her delivery? Give reasons.

E.

Questions that may be put to a medical witness in a case of supposed death by **Hanging** or **Strangulation.**

1. Did you examine the body of ——, late a resident of ——, and, if so, what did you observe ?

2. What do you consider to have been the cause of death ? State the reasons for your opinion.

3. Did you observe any external marks of violence upon the body ?

4. Did you observe any unnatural appearances on examination of the body internally ?

5. Was there any rope or other such article round the neck when you saw the body ?

6. Can you state whether the mark (or marks) you observed were caused before or after death ?

7. By what sort of articles do you consider the deceased to have been hanged (or strangled) ?

8. Could the mark you observed have been caused by the rope or other article now before you (No. —— Article in Evidence) ?

9. Do you think that this rope could have supported the weight of the body ?

(If strangulation.) 10. Would great violence be necessary to produce the injuries you describe ?

F.

Questions that may be put to a medical witness in a case of supposed death by **Drowning,** after *post mortem* examination of the body.

1. Did you examine the body of ——, late a resident of ——, and, if so, what did you observe ?

2. What do you consider to have been the cause of death ? State your reasons.

3. Were there any external marks of violence upon the body ? If so, describe them.

4. Describe any unnatural appearances which you observed on further examination of the body.

5. Did you find any foreign matters, such as weeds, straw, etc., in the hair, or clenched in the hands of the deceased, or in the air passages, or attached to any other part of the body ?

6. Did you find any water in the stomach ?

G.

Questions that may be put to a medical witness in a case of alleged **Rape.**

1. Did you examine the person of Mussamut ——? If so, how many days after the alleged rape did you make the examination, and what did you observe?

2. Did you observe any marks of violence about the vulva or adjacent parts?

3. Are these injuries such as might have been occasioned by the commission of rape?

4. Was the hymen ruptured?

5. Did you observe any further marks of violence upon the person of the woman?

6. Had she passed the age of puberty?

7. Can you state approximately what her age is? N.B.—This question only to be asked in the case of the rape of a girl of tender years.

8. Did you find her to be a strong, healthy woman, or so weakly as to be unable to resist an attempt at rape?

9. Did you examine the person of the accused?

10. Did you observe any marks of violence upon his body?

11. Was he suffering from any venereal disease?

12. Did you find the woman suffering from a similar or other venereal disease?

13. Had a sufficient time elapsed, when you examined the person of the woman, for venereal disease to have made its appearance in case of her having been infected?

14. Can you state approximately how long the defendant had been suffering from this complaint?

15. Can you state approximately how long the woman had been suffering from this (venereal) complaint?

16. Have you examined the stained articles forwarded to you, and now in Court (No. —— Article in Evidence)?

17. What is the result of your examination?

18. Do you believe that a rape has been committed or not? State your reasons.

H.

Questions that may be put to a medical witness in cases of suspected **Insanity.**

1. Have you examined ——?

2. Have you done so on several different occasions, so as to

preclude the possibility of your examinations having been made during lucid intervals of insanity ?

3. Do you consider him to be capable of managing himself and his personal affairs ?

4. Do you consider him to be of *unsound mind ;* in other words, *intellectually insane ?*

5. If so, do you consider his mental disorder to be complete or partial ?

6. Do you think he understands the obligation of an oath ?

7. Do you consider him, in his present condition, competent to give evidence in a Court of Law ?

8. Do you consider that he is capable of pleading to the offence of which he now stands accused ?

9. Do you happen to know how he was treated by his friends (whether as a lunatic, an imbecile, or otherwise) prior to the present investigation and the occurrences that have led to it ?

10. What, as far as you can ascertain, were the general characteristics of his previous disposition ?

11. Does he appear to have had any *previous* attacks of insanity ?

12. Is he subject to insane *delusions ?*

13. If so, what is the general character of these ? Are they harmless or dangerous ? How do they manifest themselves ?

14. Might such delusion or delusions have led to the criminal act of which he is accused ?

15. Can you discover the *cause* of his reason having become affected ? In your opinion, was it *congenital* or *accidental* ?

16. If the latter, does it appear to have come on suddenly or by slow degrees ?

17. Have you any reason for believing that his insanity is of *hereditary* origin ? If so, please to specify the grounds for such an opinion, and all the particulars bearing on it ; as to the insane parents or relatives of the accused ; the exciting cause of his attack ; his age when it set in ; and the type which it assumed.

18. Have you any reason to suspect that he is, in any degree, *feigning* insanity ? If so, what are the grounds for this belief ?

19. Is it possible, in your opinion, that his insanity may have followed the actual commission of his offence, or been caused by it ?

20. Have you any reason to suppose that the offence could have been committed during a *lucid interval,* during which he could be held responsible for his act ? If so, what appears to have been the duration of such lucid interval ? Or, on the

contrary, do you believe his condition to have been such as altogether to absolve him from legal responsibility?

21. Does he now display any signs of *homicidal* or of *suicidal* mania, or has he ever done so to your knowledge?

22. Do you consider it absolutely necessary, from his present condition, that he should be confined in a lunatic asylum? or again:

23. Do you think that judicious and unremitting supervision *out of an asylum* might be sufficient to prevent him from endangering his own life, or property of others?

I.

Questions that may be put to a medical witness in a case of alleged **Causing Miscarriage** (*ss.* 312–316, I. P. C.).

1. Did you examine the person of Mussamut —— ? If so, when? and what did you observe?

2. Are you of opinion that a miscarriage has occurred or not? Give your reasons.

3. In what mode do you consider the miscarriage to have been produced—whether by violence per vaginam, or by external violence, or by the use of irritants *internally?* Give your reasons.

4. It is alleged that a drug called —— was used; state the symptoms and effects which the administration internally of this drug would produce. Do you consider that it would produce miscarriage?

5. Can you state whether the woman was quick with child when the miscarriage was produced? State your reasons.

6. Did you see the fœtus? If so, at what period of gestation do you consider the woman to have arrived?

J.

Questions that may be put to a medical witness in a case of **Grievous Hurt.**

1. Have you examined ——? If so, state what you observed.

2. Describe carefully the marks of violence which you observed.

3. In what way do you consider the injuries to have been inflicted? If by a weapon, what sort of a weapon do you think was used?

4. Do you consider that the injuries inflicted could have been caused by the weapon now shown to you (No. —— Article in Evidence)?

5. What was the direction of the wound? and can you form an opinion as to the position of the person inflicting such a wound, with respect to the person receiving it?

6. Is it possible for such a wound to have been inflicted by any one on his own person? Give your reasons.

The magistrate in putting this question will show the I. P. Code to the witness; or the magistrate may vary the form of the question so as to elicit the required information without calling the witness's attention to the I. P. Code.

7. Do you consider that the injuries inflicted constitute any of the grievous hurts defined in *s.* 320 of the Indian Penal Code? If so, which of them? Give your reasons.

8. Do you consider that the person injured is now out of danger?

9. It is alleged that the injuries were caused by——. Could they have been caused in the manner indicated?

10. Have you chemically or otherwise examined the stains (on the weapon, clothes, etc.) now before you (No. —— Article in Evidence)?

N. B.—In case of the injuries being gunshot wounds, questions 21 to 24 under the head of No. III. (death by wounds) may be put to the witness.

11. Do you believe the stains to be those of blood?

Police Code No. 189.

II.

Legal Definitions of an "OFFENCE," and its Detailed PUNISHMENT.

In India, "offences" are defined, and the punishment awardable for each offence limited, by the *Indian Penal Code* (Act XLV. of 1860), certain general provisions of which may be here considered.

A. Acts are not offences if they come under certain general exceptions laid down in the Code. The principal of these are, that acts are not offences if done—

I. By a child under the age of seven. (*S.* 82.)

II. By a child between the ages of seven and twelve (not as in England between the ages of seven and fourteen), "who has not attained

sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion." (*S.* 83.)

III. By a person of unsound mind, "if by reason of unsoundness of mind the doer of the act is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." (*S.* 84.)[1]

IV. By an intoxicated person, but only, provided,

(1) "the thing which intoxicated him was administered to him without his knowledge or against his will;" and

(2) when by reason of the intoxication so induced, the intoxicated person is "incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." (*S.* 85.)

V. In good faith, and for the benefit of the person on whose body the act is done (under this exception come surgical operations), provided certain conditions are complied with, the chief of which are—

1. That the act must not be intended to cause death. (*S.* 88.)

2. That the act must not of itself be an offence independently of any harm it may cause to the person on whose body the act is done; *e.g.* causing miscarriage, except for the purpose of saving the life of the mother. (*S.* 91.)[2]

3. That the act is done with the consent of the sufferer, such consent—

a. Not being known to the doer of the act to have been given under fear of injury or misconception of fact;

b. Not having been given by a person under twelve years of age;

c. Nor having been given by a person who by reason of unsoundness of mind or intoxication is unable to understand the nature and consequence of that to which he gives his consent. (*S.* 90.)

Consent of the sufferer may, however, be dispensed with, if—

1. He is of unsound mind or under the age of twelve, if the consent of the person having lawful charge of him has been obtained (*s.* 89); or

2. The circumstances are such that it is impossible for him to signify his consent, and he has no person in lawful charge of him from whom it is possible to obtain consent, in time for the thing to be done with benefit. (*S.* 92.)

But in those cases where consent is dispensed with, an act which is known to be likely to cause death or grievous hurt, may only be done for the purpose of preventing death or grievous hurt,[3] or for the curing of any grievous disease or infirmity. (*S.* 89.)

B. An offence may be committed by illegal omission (*s.* 32); thus, a woman may commit murder by intentionally omitting to supply her infant with food.[4]

C. Attempts to commit offences are, in some cases, punishable under special sections of the Code, *e.g.* an attempt to commit murder (*s.* 307), or culpable homicide not amounting to murder (*s.* 308), or suicide (*s.* 309). Attempts not punishable under special sections of the Code are dealt with by *s.* 511: "Whoever attempts to commit an offence punishable by this Code with transportation or imprisonment, or to cause such an offence to be committed, and in such attempt does any act towards the commission of the offence, shall, where no express provision is made by this Code for the punishment of such attempt, be punished with transportation or imprisonment of any description provided for the offence, for

[1] See also 'Insanity,' p. 353 f.; also p. 388.

[2] See also 'Causing Miscarriage,' p. 315 f.

[3] See 'Wounds,' p. 103 f.

[4] See 'Infanticide, p. 328 f.

a term of transportation or imprisonment which may extend to one-half of the longest term provided for that offence, or with such fine as is provided for the offence, or with both." [1]

D. The punishments awardable for offences are defined by *s.* 53 of the *Penal Code* to be: 1. Death. 2. Transportation. 3. Penal servitude. 4. Imprisonment, which may be either (*a*) Rigorous, that is, with hard labour; or (*b*) Simple, that is, without hard labour. 5. Forfeiture of property. 6. Fine. And under Act VI. of 1864, whipping may be awarded for certain offences. The chief medico-legal points in connection with these punishments are :—

I. Death.—This (see *s.* 368 of Act X. of 1882, the Code of Criminal Procedure) must be by hanging. Pregnancy may be pleaded in bar of execution: "If a woman sentenced to death be found to be pregnant, the High Court shall order the execution of the sentence to be postponed, and may commute the sentence to transportation for life." (*C. P. C.*, *s.* 382) In India the question by whom the existence or otherwise of pregnancy is to be determined appears to be left to the discretion of the Court. In England, according to an old rule of law, in such cases a jury of twelve matrons is empanelled and sworn, to try whether the "prisoner be with child, of a quick child." [2]

II. Hard Labour.—A medical man may be called on to determine whether a prisoner is in a fit state of health or not to perform certain descriptions of labour; in such a case, the chief points for inquiry would be as to—

1. The prisoner's general health.
2. His freedom or otherwise from cardiac disease, aneurism, or grave disease of the respiratory organs.
3. The nature of the labour (if any) he has previously been engaged on, and whether he has been gaining or losing weight.
4. The proportion borne by the labour it is proposed to exact to the weight of the individual, 2 foot-tons per 1 lb. of body-weight being an ordinary, and 3 foot-tons per 1 lb. of body-weight a very hard day's work. In many cases labour to be performed may be reduced to foot-tons by Haughton's formula, which may be stated as follows: Add together the body-weight of the individual (in pounds), and the weight (in pounds) carried by him; multiply this by the height (in feet) ascended, plus one-twentieth of the horizontal distance (in feet – 1 mile = 5280 feet) travelled, and divide the product by 2240.

III. Whipping.—Here the principal points are—

1. All females, and all males over forty-five years of age, are exempted. (*C. P. C.*, *s.* 393.)
2. A medical man may be called upon to certify whether or no an offender is in a fit state of health to undergo this punishment. (*C. P. C.*, *s.* 394.)
3. A medical man may, during the execution of a sentence of whipping, be called upon to certify as to the fitness, or otherwise, of the offender to undergo the remainder of the sentence, and should he certify that the offender is not in a fit state of health to undergo the remainder of the sentence, the whipping must be finally stopped, *i.e.* the remainder of the sentence cannot at some future period be inflicted. (*C. P. C.*, *s.* 394.)

[1] See also 'Causing Miscarriage,' p. 315 f.
[2] See 'Pregnancy,' p. 275.

III

(This is cited on p. 90.)

NECROPSY or POST-MORTEM EXAMINATION DIRECTIONS.

THE order of examination should always be that here given, unless special reasons of the nature before indicated exist for departure therefrom. Incisions made through the skin for the purpose of opening cavities should avoid already existing external wounds. If on dissection any internal injury is found likely to have resulted from external violence, careful examination should be made—if this has not already been done—for signs of violence in the tissues between the seat of injury and the surface of the body; and for marks of violence on the surface of the body over the seat of injury. Any unusual appearances found, in addition to those already mentioned, should be recorded.

I.—THE HEAD.

The internal examination of the body should commence with dissection of this cavity :—(*a*) in cases where the cause of death is doubtful, and (*b*) when it is suspected that death has been due to head injury, or has occurred by coma.

Procedure.	Appearances to be looked for and recorded.
1. Make an incision through the integuments from ear to ear over the vertex and reflect the scalp, one flap forwards, the other backwards.	(*a*) Extravasations of blood in or under the scalp, their situation and extent. (*b*) Injuries to the bones of the skull-cap visible externally, viz. separation of sutures, fractures, or indentations; their situation, extent, and direction (see 2 *b*, below).
2. Saw through the skull by a circular cut at the level of about an inch above the orbits in front, and of the occipital protuberance behind, detaching the skull-cap without using the chisel. Raise the skull-cap from before backwards, separating the dura mater from it.	(*a*) Unusual thinness of the skull bones. (*b*) Complete 1 *b*, above, by examining inner surface of skull-cap. (*c*) Fullness (or the reverse) of the longitudinal sinus. (*d*) Condition of the membranes of the brain, *e.g.* amount of adhesion, if any, of the dura mater to the skull-cap, presence of congestion or signs of disease. (*e*) Extravasations of blood between the skull-cap and the brain, their situation and extent.
3. Divide and reflect the dura mater on either side. *N.B.*—If the dura mater is so firmly adherent to the skull-cap as not to be easily separable, it should be divided carefully and removed with the skull-cap.	

Procedure.	Appearances to be looked for and recorded.
4. Remove the brain carefully, place it base downwards, and proceed to slice it horizontally from above.	(*a*) Extravasations at the base of the skull, their situation and extent. (*b*) Volume of any serous fluid found within the skull or ventricles of the brain. (*c*) Weight, colour, and consistence of the brain (and in immature infants its condition of development, pp. 282 f.). (*d*) Apoplectic effusions within the substance of the brain, their situation and extent. (*e*) Freedom or otherwise from disease of the coats of the cerebral arteries.
5. Strip off the dura mater from interior of the skull.	(*a*) Fractures of the base of lateral portions of the skull, their situation, extent, and direction, and thickness of the bones at the seat of the fracture. (*b*) In infants, presence of air in the cavity of the tympanum.
6. Examine the upper portion of the spinal cord through the foramen magnum.	If any signs of injury to the cord or upper cervical vertebræ are found, proceed at once to IV., returning subsequently to II.

II.—THE THORAX (including preliminary examination of the abdominal cavity).

The internal examination of the body should commence here, in cases where death appears to have been due to chest injury, or to have occurred by asphyxia. Also when there is reason to believe that the cause of death is connected with the contents of the abdomen. In this last case, after II. 1 proceed to III. (see *N.B.* below).

1. Make a long incision from a little above the sternum down to the pubes, reflect the integuments on either side, laying open the abdominal cavity but not the cavity of the thorax. In infants take care to carry the incision a little to the left of the umbilicus.	(*a*) Position, colour, and general appearance of the exposed viscera. (*b*) Presence of abnormal contents, *e.g.* blood, products of inflammation, or tumours. (*c*) Determine with the hand (especially in new-born infants) the position of the diaphragm, noting whether the upper level of this is between the fifth and sixth ribs (see Chap. XVI.), or higher. *N.B.*—Should this preliminary examination indicate, or there be reason to believe, that the cause of death is connected with the contents of the abdomen, proceed at once to III., subsequently returning to II. 2.

Procedure.	Appearances to be looked for and recorded.
2. Complete the reflection of the integuments over the thorax to a point beyond the junction of the cartilages of the ribs.	(*a*) Extravasations of blood or signs of bruising in the integuments of the front of the chest, their situation, and extent. (*b*) Fractures of the anterior portions of the ribs, their situation, and the direction in which the fractured ends appear to have been driven (see also II., 9 *c*).
3. Divide the rib cartilages as far from the sternum as possible, or, if these are ossified, cut through the ribs a little outside the cartilages. Cutting upwards, close under the rib cartilages, raise the sternum and cartilages. Do not cut through the sternoclavicular joints, as blood from the underlying large veins flows into the pleural cavity. When the cartilages have been cut forcibly draw the sternum upwards till it fractures without injuring the veins.	(*a*) Volume of the lungs, *i.e.* whether projecting out of the chest (indicating emphysema); or expanded and nearly covering the pericardium, but not projecting; or collapsed, exposing the pericardium, (*b*) Colour of the lungs; in infants, whether dark red or bright red. (*c*) Fluid in the pleural cavities, nature and volume. (*d*) Adhesions of the lungs. (*e*) Condition of the thymus gland. (*f*) Tumours in the thorax.
4. Open the pericardium.	(*a*) Condition of the pericardium; nature and volume of any fluid present therein. (*b*) Size, colour, and consistence of the heart and condition of fullness of the coronary vessels.
5. Without removing the heart from the body, open its cavities in the following order: (1) R. ventricle; (2) R. auricle; (3) L. auricle: (4) L. ventricle. Incision required: (1) Along the right border of the heart, beginning close to the base and ending short of the apex. (2) Begins midway between the entrances of the venæ cavæ, and ends just in front of the base. (3) Begins at the left superior pulmonary vein, and ends just in front of the base, short of the coronary vein. (4) Begins behind the base and ends short of the apex.	Note, as each cavity is opened, the amount and condition of its contents.
6. Remove the lungs and heart together. *N.B.*—In cases where it is suspected that death has been due to injury to the neck, and in cases where the condition of or presence of foreign matters in the	(*a*) Presence on the surface of the lungs of Tardieu's spots, or patches of emphysema (see Strangulation and suffocation). (*b*) In new-born infants, note if inflated air-vesicles are visible on the surface of the

Procedure.	Appearances to be looked for and recorded.
gullet or air-passages is likely to be of importance, proceed after 5 or 10, returning to 6 *et seq.* afterwards.	lung, and distinguish between these and bubbles of gas due to putrefaction (see pp. 335, etc.); then proceed to the hydrostatic test, noting while dividing the lungs whether they exude frothy blood freely and crepitate, or show signs of disease.
7. Separate the heart, and test the condition of the arterial openings by pouring in water.	(*a*) Condition of the cardiac valves, tufts of fibrin on their edges, etc. (*b*) Livid patches on the endocardium (see Arsenic). (*c*) Condition of the heart tissue. (*d*) In new-born infants, condition of the foramen ovale. (*e*) Conditions of the portions of the large vessels remaining attached to the heart.
8. Make long incisions into each lung, and, if necessary, follow the branches of the bronchial tubes and pulmonary artery by dividing them with scissors.	(*a*) General characters of the lung tissue. (*b*) Disease of the lungs. (*c*) Apoplectic effusions into the lung substance (see Strangulation). (*d*) Condition of the bronchial tubes, nature and quantity of foreign matters present therein (see Drowning). (*e*) Condition of the branches of the pulmonary artery, noting any obstruction.
9. Previous to opening the descending aorta, tie two ligatures round the œsophagus near the diaphragm, divide the œsophagus between them and dissect it out of the way.	(*a*) In newborn infants, note the condition of the ductus arteriosus. (*b*) Examine the aorta for atheroma and aneurism. (*c*) Complete the examination of the ribs for fractures.
10. Prolong the incision upwards to the chin, reflect the skin as far back as possible; separate the soft parts from the inside of the lower jaw, cutting close to the bone. Pull the tongue forwards below the chin, and carry the dissection backwards, separating the pharynx and œsophagus with the larynx and trachea from the spine. Open in succession the larynx, trachea, and œsophagus.	(*a*) Foreign bodies, marks of corrosion, etc., in the larynx, trachea, and œsophagus. (*b*) Examine the large vessels of the neck for injury, obstruction, etc., opening them carefully. (*c*) Ascertain the condition of the cervical vertebræ.

III.—THE ABDOMEN.

In Infants the condition of the umbilical vessels, and of their continuations within the abdomen, should, so far as can be done without removal of any of the abdominal viscera, now

be ascertained, completing the examination after the remaining portions become exposed by removal of the viscera.

In all cases examine first generally, and without further dissection, the abdominal viscera *in situ*. Should this examination show, or should there be reason to believe, that the cause of death is connected with any particular organ, the further examination should commence with the organ or organs concerned. Thus in cases of poisoning the further examination should commence with the stomach and intestines. Each viscus should be carefully examined *in situ* previous to its removal for further examination, noting particularly any enlargement or unusual appearance and any wound or sign of injury. If a wound be present, its precise situation, direction, and appearance should be described, and it should be noted whether or not any blood is effused in its neighbourhood. The general consistence of the injured viscus should also be noted. Each viscus is then to be removed, and, after removal, further examined, as below.

1. **The Liver.**—Note its weight and appearance on section. This may be (*a*) uniform dark brown = *normal*, or (*b*) either uniform dark red, the cut surface exuding blood pretty freely; or of a nutmeg appearance, *i.e.* in some places dark red, in others buff or yellow = *congestion*; or (*c*) texture dense and tough, surface irregular = *cirrhosis*; or (*d*) in places soft pale yellow, and greasy = *fatty*; or (*e*) uniformly pale yellow, and reduced in size = *yellow atrophy*; or (*f*) enlarged and heavy, consistence doughy, cut surface greyish and glistening or semi-translucent in appearance = *amyloid* or *lardaceous*. Note presence of abscesses or tumours. Note also the condition of the gall-bladder, and the nature of its contents. If there be any reason to suspect death from poison, preserve for analysis a large portion of the liver, at least one pound in weight.

2. **The Spleen.**—Note its size, weight, and appearance on section. If death has been due to rupture of this organ, it is of special importance to note its consistence, and whether or not any signs of injury are present on the surface of the body over it, or in the tissues lying between it and the surface of the body.

3. **The Kidneys.**—Note in regard to each its weight, and whether or not the capsule peels off readily. Then, commencing at the convex border, make a long incision through it as far as the pelvis, and note if any signs of inflammation of the lining membrane be present. Note the condition of the cut surface.

Congestion accompanied by softening and enlargement, or pallor similarly accompanied, indicate inflammation respectively in the early and later stage. Again, the capsule may be adherent, the viscus reduced in size, and its section granular or cystic = *forms of chronic Bright's disease;* or the kidney may be enlarged, the capsule non-adherent, and the section pale, waxy, smooth, and glistening = *amyloid degeneration.* Note the presence of morbid growths or tubercular deposit. In cases of poisoning preserve one or both kidneys for analysis.

4. **The Pelvic Organs.**—Tie two ligatures round the lower part of the larger intestine a little above the rectum, and divide the gut between them. Open the urinary bladder *in situ* and determine its contents, preserving any urine found for subsequent analysis. In male infants, note the position of the testicles. Then, having examined each organ *in situ*, remove the whole of the pelvic organs together, and complete the examination of the bladder, ureters, and urethra, noting in males the size of the prostate and the condition of the testicles. Examine the rectum, noting specially in infants the presence or absence of meconium.

In Females, examine the generative organs as follows:—

(*a*) The vagina.—This is to be opened first and examined for marks of injury and presence of foreign bodies, preserving any matters found for analysis. Its colour, the presence or absence of rugæ, and the condition of the hymen are also to be noted.

(*b*) The uterus.—Measure externally its length and greatest breadth. Take its weight. Then open it by an incision from fundus to cervix, and note the dimensions of its cavity and the thickness of its walls (see 'Abortion,' p. 315 ff.). Note the nature of its contents, if any, and if a fœtus be present determine its age (see table, p. 291). Record the condition and colour of the lining membrane and muscular substance, presence of internal injuries, or of morbid growths.

(*c*) The ovaries.—Note in regard to these their size and external appearance, and after section examine for signs of disease and for true and false corpora lutea (see p. 326).

5. **The Stomach.**—Before removing this viscus tie two ligatures round the duodenum close to the stomach, and divide the gut between these ligatures. (If the abdominal cavity is dissected before the thorax, a similar procedure must, before removing the stomach, be adopted with the œsophagus (see p. 729, 9).) In infants, before opening the stomach, note if any air appears to be contained in it (see p. 337). Then place

the stomach in a clean jar or photographic developing dish and open it along its lesser curvature, collecting its contents in the vessel. Note the volume of the fluid contained in the stomach, its general appearance, the character of any matters suspended in it, and any peculiar odour possessed by it. In infants, examine the contents of the stomach for the presence of milk, food, etc. (see 'Infanticide,' p. 337). *If there is any reason to suspect poisoning, preserve the contents of the stomach for analysis* and note carefully the condition of the mucous membrane, and examine for the presence of adhering particles of poison. Any suspicious-looking particles should be picked off with a pair of forceps and separately preserved for analysis.

6. **The Intestines.**—These should be removed like the stomach, and, after removal, should be laid open along their whole length, preserving, in cases of suspected poisoning, their contents for analysis, with precautions similar to those observed in preserving the contents of the stomach. In the case of infants note if meconium be present, and its position. Note the condition of the mucous membrane, presence of any erosions, ulcers, or perforations, and the condition of the agminate and solitary glands.

N.B.—After completing the dissection of the abdomen, proceed to the dissection of the thorax, should this cavity not have been already dissected (see p. 728, 2).

IV.—THE SPINE AND SPINAL CORD.

This should be examined in all cases where it is likely to have been injured, or where symptoms of irritation or inflammation have been present or tetanus or poisoning by strychnine, etc., suspected. It should always be the final object examined, so that this rough operation may not injure or obscure the condition of other cavities and organs. Procedure: divide the integuments down to the bone by an incision in the middle line along the whole length of the spinal column; reflect the integuments on either side and cut away the muscles from the arches of the vertebræ. In carrying out this dissection, note any extravasations of the blood in the tissues over the spine and any fracture of the bones which may be exposed. Then saw through the vertebral arches on either side and remove the detached portions of bone. Examine the outer surface of the exposed dura mater, then slit it open carefully along its whole length, and examine the exposed portion of the pia mater *in*

situ. Next pass the finger gently down the cord, noting its consistence; then remove the cord from the body and complete its examination, making for this purpose transverse incisions through it in several places. Finally, remove the dura mater from the interior of the spinal canal, and complete the examination of the vertebræ for fractures.

V.—THE KNEE JOINT.

In new-born infants this joint should be opened by a transverse incision in front, the lower end of the femur pushed out through the wound, and the cartilage at the end of the bone sliced transversely in fine slices until a pink spot appears in the cut surface; very fine slices are then to be made and the greatest diameter of the bony nucleus ascertained (see pp. 48 and 286).

[The instruments used in the *post-mortem* examination should after washing be sterilized by heat. This may be done by dipping the blade into benzine and then applying a light the flame being sufficient to sterilize the metal.]

WEIGHTS OF VISCERA.

The weights of the viscera should be ascertained if possible. The table[1] below shows the average weights of the chief viscera of adult natives of Bengal and Bihar who have died in gaols of disease.

Organ.	No. of cases.		Average weight.		Highest.		Lowest.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
			oz.	oz.	oz.	oz.	oz.	oz.
Liver ..	333	88	44	37½	108	62	13	16
Spleen ..	314	91	10⅓	6½	64	48	1	1
Lung, R. ..	224	49	16	9½	52	20	5	6
,, L. ..	224	49	14⅓	9½	43	17	5	4
Heart ..	238	46	7⅓	6	20	9	4	4
Kidney, R.	246	68	3¾	3½	8	6	2	1
,, L.	246	68	3¾	3½	8	6	2	1
Brain ..	143	7	33	37	56	42	33	26

Average height 5 ft. 3 in. Average weight 110 lbs. Based on 28,000 cases.—*I. M. G.*, Oct., 1897.

[1] Compiled by Major W. J. Buchanan and Captain Maddox, I.M.S., *Ind. Med. Gaz.*, June, 1902.

The average weight for Europeans is :—

IN ADULT EUROPEANS (according to Tidy).

Organ.	Male	Female
	oz.	oz.
Brain	49½	44
Lungs (together)	45	32
Heart (usually about, in inches, 5 × 3½ × 2½)	9½	8¾
Stomach	4½	A little less than 4½
Liver	50—60	45—55
Spleen	5—7	5—7
Pancreas	2¼—3½	2¼—3½
Kidneys (together)	9	8⅔

In the female the brain and lungs are lighter than in males by 5½ and 13 oz. respectively.

IV.

MEDICO-LEGAL REPORT.—FORM.

The following documents should be sent to the Chemical Examiner in connection with medico-legal cases of suspected crime.

HUMAN POISONING.

I. **Fatal Cases.**—By post.—1. *Post Mortem* Report (No. 1).

NOTE.—Information on the following toxicologically important points should invariably be supplied :—(*a*) date and hour of onset of symptoms; (*b*) date and hour of patient's death; (*c*) in cases where the body has been exhumed, the dates of burial and of exhumation should be mentioned. In all cases the entire stomach and contents, with portions of liver and kidney, should be sent. In *datura* cases, portions of the small intestine should also be sent.

2. Statement of symptoms supplied by the police to the forwarding medical officer.

3. Note of treatment, if any, adopted in the case (by the medical officer, police, or patient's friends).

4. Police reports (not vernacular) sent with the case to the forwarding medical officer.

5. Nature of the preservative used. (Rectified spirits to be

used except in suspected alcohol, phosphorus, or carbolic acid cases.)

6. The seal should, if possible, be a private one, and the same seal should be used throughout.

Under the cover of the box containing the articles for analysis:

Memo. stating (*a*) deceased's name and (*b*) number and date of *post mortem* report.

II. **Non-fatal Cases.**—By post.—Medico-legal Form No. II., laying stress on the following:—

(*a*) Symptoms observed by the medical officer or reported by the police.
(*b*) Note of treatment adopted (if any).
(*c*) Police reports (not vernacular) forwarded with the case to the forwarding medical officer.
(*d*) Nature of the preservative, if any, that has been used.

Under the cover of the box containing the articles for analysis:

Memo. stating number and date of medico-legal form used and name of case.

ABORTION CASES.

Fatal.—Same as in fatal human poisoning cases, but, in addition, the uterus should invariably be sent, along with any foreign bodies found in the genital tract.

Non-fatal.—Same as in non-fatal human poisoning cases, but, in addition, care should be taken to forward any foreign bodies expelled or removed from the vagina or uterus.

BLOOD CASES.

In blood and semen cases particular care must be taken to forward the magistrate's certificate permitting the removal of exhibits for chemical examination along with the exhibits.

1. Medico-legal Form No. II.
2. Memo. with name of case and number and date of medico-legal form used to be enclosed along with the articles for examination.
3. The entire garment, etc., must be sent, and a label should be stitched (never gummed or pasted) to each separate article.
4. Knives or other weapons should bear a label tied on to them, and the string should be sealed.

SEMEN CASES.

1, 2, and 3. As in blood cases.

4. Care should be taken that the cloth be not folded at the stained portion. The stain should be kept quite flat. The stained places should be protected by a thin layer of cotton wool on each surface, as pressure may suffice to crush the spermatozoa beyond the possibility of recognition under the microscope.

5. Where possible, slides should be prepared from vaginal mucus, etc., in cases of rape or unnatural offence.

CATTLE CASES.

(Fatal and Non-fatal.)

By post.—1. Medico-legal Form No. II.

2. A sample of the preservative used in the case. (A saturated solution of common salt to be used for cattle cases.)

Under the cover of the box containing the articles for analysis:

Number and date of medico-legal form used and name of case.

NOTE I.—In sui-poisoning cases the punctured portion should always be searched for the needle or its fragments or any other foreign substance. Such articles should be packed separately.

NOTE II.—It is very important that portions of stomach and of liver be sent in all cases.

MISCELLANEOUS.

Attention is also directed to the following points:—

1. Bottles of sufficient size must be used. If viscera are tightly packed into bottles and insufficient space left for the preservative fluid, they will necessarily arrive in a decomposed and probably useless state. The fluid should have free access to every part of the specimen, which should, in fact, almost float in the fluid, so that no matter in what position the bottle may be placed, the viscera will always be covered by the fluid.

2. Under no circumstances should viscera from different cases be included in the same parcel.

3. If two or more examinations have to be made on the same occasion, the medical officer should complete one and label and seal the articles connected with it before commencing a second examination, otherwise there is a risk of the viscera, etc., of one case getting mixed with those of another.

4. In cases where the police send a closed parcel through a medical officer, and the latter has no occasion to open it in transmission, the parcel should be placed in a second cloth cover, and the memo. referred to in the above instructions should be placed under this fresh cover. This procedure is necessary in order to prevent cases getting mixed up on receipt in the chemical examiner's office.

5. The impression of the seal attached to forwarding letter should be protected on both sides by a thin layer of cotton-wool to prevent the wax being powdered in transit.

6. The labelling and numbering of articles should not be in the vernacular, but in English.

20, B. C. M. D.

V.

HYPOSTASIS *v.* INJURY.

(Refer, p. 84.)

Bain Case.—Hypostasis mistaken for Injury.—This was a celebrated case in Calcutta High Court, 1903. A *post mortem* examination was made on the body of Lalsa, a coolie male, aged 30, by Dr. Chandler, B.SC. Cantab., who had formerly acted as assistant pathologist to Guy's and the Evelina Hospitals. He found the day after death all the dorsal and dependent surface of the body of a livid dusky colour in diamond-shaped patches, bounded by white lines corresponding to the ropes of the *charpoy* on which the body lay. He considered these marks due to suggillation. Internally he found disease of the mitral valves; the base of the left lung consolidated but containing two abscesses with thickened walls. There was recent pleurisy of both sides. He looked upon these evidences of disease as a satisfactory cause of death. He found no signs of injury.

The body was then buried in a shallow damp grave. Four days later the body was exhumed. On the *sixth day after death*, a second autopsy was performed by Lt.-Col. Borah, I.M.S., who reported that the body was decomposing: that rigor mortis was present!!! that he found the abscesses of the lung to contain a thick, creamy, soap-like substance. (This portion of the lung has been preserved in formaline.) That all cusps of the mitral valve were much thickened; the heart hypertrophied: that the brain was decomposing and contained about half a drachm of reddish serum in "both third ventricles" (*sic*), that the lateral fourth and fifth ventricles were normal. The marks on the dorsum were in his opinion contusions due to blows with a stirrup leather. He was of opinion death was due to *shock the result of prolonged beating with a stirrup leather*. He was of opinion that double pleurisy, two abscesses in a consolidated patch of lung combined with mitral disease could not have caused death.

He relied on the "colour of the serum in both third ventricles" as satisfactory evidence of shock!

The accused was found guilty by the Sessions Court, but on appeal the High Court reversed the judgment.

It is hardly necessary to point out the absurdities of this *post mortem* examination :—

1. Duration of rigor mortis to the sixth day in a body that had been handled, cut open, buried, again handled, carried fifteen miles on a charpoy in a damp tropical climate.
2. The skill that must have been used to give innumerable bruises all on the dorsum with a leather strap that never once coiled round to the ventral surface.
3. The value attached to the reddish serum in "both third ventricles" of a decomposing brain, which apparently did not communicate with the other ventricles.

Needless to say the most expert pathologist is not justified in attributing death to shock except in the absence of physical signs of any other cause of death, combined with a reliable history of some recognized accident capable of giving rise to fatal shock.

VI.

EARLY FORMATION OF ADIPOCERE.

(Refer, p. 91.)

By Arthur Powell, M.B., M.S., Professor of Medical Jurisprudence, Bombay University, in *B.M.J.*, 1917.

In India several cases of early formation of adipocere have been recorded, especially by Coull Mackenzie (*Ind. Med. Gaz.*, 1889) and Major Moir, I.M.S. (*Idem.*, May, 1897).

The accuracy of these observations has been disputed by many.

Dr. R. S. Ashe recorded a case in which he sent some of the tissues to the Chemical Examiner, who only reported "very partial saponification had taken place," after four days' burial and some days in transit.

I was myself somewhat sceptical of the accuracy of previous observations, and in my own experience of many thousand autopsies adipocere was very rare.

The following should, however, satisfy the most critical :—

Yakub Hatham, healthy male, aged 35, was assaulted and a heavy rock thrown on his back while lying at the bottom of a ditch. He died at 1 p.m. and was buried at 5.30 p.m. on 11th September, 1916, in the Mussalman Cemetery, Bombay. The soil was chiefly gravel and shale, almost at the sea-level. There was an exceptionally heavy rainfall before and during the period of his burial.

His body was exhumed and I made an autopsy at 11 a.m., 15th September, 1916—three days twenty-two hours after death.

There was little smell considering the decomposed aspect of the body. The stomach had ruptured from decomposition. The intestine was fairly well preserved. The spleen had become diffluent and lay like a quantity of soft soap in the peritoneal cavity.

The heart, liver and kidneys were of a pale colour and felt soapy

and greasy. The pancreas looked and felt like soap, its outline well preserved.

The muscles and tissues generally were partly turned into a soapy substance which stuck to the hands. On washing the hands without the addition of soap, this substance formed a greasy lather.

Lumps of a soapy substance, weighing 210 grains altogether, were removed from the region of the cheeks and temples and submitted for analysis to Major W. H. Dickinson, I.M.S., Professor of Chemistry in this University, Chemical Analyst to Government. These lumps looked and felt exactly like pieces of Old Brown Windsor soap.

Parts of the substance shaken up in water formed frothy "suds" at surface. Selected lumps almost completely dissolved in alcohol, leaving a small deposit at the bottom of the tube. No structure could be recognized with the microscope in this deposit except doubtful portions of small arteries.

The supernatant alcoholic solution formed an opaque milky emulsion on the addition of water.

Major Dickinson reported: "The substance sent is adipocere."

The dates given above are definite and were sworn to at the inquest, and at trials in the police court and in the High Court

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VII.

SHALLOW DROWNING.

(Refer, p. 234.)

Case (*a*).—**Drowning in Shallow Water.**—An ayah, aged 35, went to prepare a bath for a baby in a hot steaming bathroom. Shortly after her mistress found her dead kneeling on the floor at the side of the small bath, with her head submerged in the water. The lungs and air passages contained much water. She was very anæmic and weak as a result of a miscarriage, and had doubtless fainted while leaning over the bath.

Case (*b*).—The dead body of a young Hindu woman was found lying on a stretcher in one of the principal streets of Bombay.

On examining the body I found the clothes and hair dry and not disarranged. Copious fine froth was exuding from the nose and mouth. Internally the trachea, bronchi and lungs contained much froth and water. When cut into the lungs dripped much water. There was no evidence of tubercle or inflammation. The right lung weighed 27 oz., the left 22½ oz. The body was still warm and rigor mortis had not set in when found. The spleen weighed 17 oz. and contained ring and crescent malarial parasites. Heart and kidneys normal.

There was no doubt she had been drowned, but the question to be solved was, Why were the body and clothes dry? Some hours later her relations claimed the body, and gave the history that she had been suffering from vomiting and fever. During the vomiting she had been given two bottles of soda-water which caused her to choke and splutter. As treatment for the choking more water was poured into her mouth while her head was held! This must have got into the air passages and caused her death.

The husband explained that he and two friends were carrying the body, but finding the weight too much for them he and one of the friends went to get help. In the meantime the police arrived and began to raise an outcry which terrified the remaining friend so that he bolted.

No poison of any kind could be found in the body.

VIII.

HYMEN IN VIRGINITY AND DEFLORATION.

(Refer, p. 270.)

Practitioners often have the most vague conception of the hymen. A common error is to mistake for it the thin margin of the fourchette. The hymen or its remnants lies deeper than the fourchette and the labia minora. It can be readily seen even in infants by placing them in the lithotomy position and gently separating the labia.

It consists of a thin membranous diaphragm seldom exceeding in thickness the frænum of the tongue, surrounding an opening either central or excentric. In the latter case, more commonly situated in the anterior than the posterior part of the membrane. When intact it is usually of a homogeneous colour, paler than the surrounding mucosa and free from visible blood vessels on its surface.

Its appearance in each case depends on—

1. Its consistence.
2. (*a*) The size.
   (*b*) The situation.
   (*c*) Number and
   (*d*) Shape of its aperture.

The opening is commonly central, circular or oval with its long axis antero-posterio.

Its margin is usually entire, but may have one or more notches, be crenate or even fimbriate in the virgin condition. In such cases the crenations are not nodular, and are of the same soft consistence as the rest of membrane.

A common variety is a crescentic fold parallel with the fourchette, stretched across the posterior wall of the vagina, its concavity looking forward, the horns of the cresent becoming lost on the anterior or lateral walls.

In rare cases it may be imperforate.

In a few cases the opening is double owing to the presence of a transverse or longitudinal bridle.

In other cases the openings may be numerous, producing the cribriform hymen.

In many cases the opening is irregular in shape, triradiate or notched in various ways. These notches, unless the result of trauma or connection, do not produce cicatricial nodules on the margin of the opening.

In consistence the hymen is usually thin—as thin as the margin of the frænum linguæ or even thinner, but it may be thick—even fleshy.

In a recent case of alleged rape on a child 11 years old, the hymen formed a thick, circular elastic ridge with smooth, rounded, entire margin

as thick as the web between her fingers, and, without stretching, admitted my index finger.

As the alleged rape took place ten days previous to my examination, all I could say was that I found no evidence of penetration, but that penetration might well have taken place without producing any tear.

The hymen after intercourse.—When the aperture of the hymen is penetrated by the penis or other suitable foreign body its margins become torn in one or more places. The edges of the tears heal by granulation, and for five or six days a raw or granulating surface may be seen. After the lapse of eight or ten days cicatrization is complete. On each side of the tear small rounded nodules of scar tissue known as the caruncles remain.

The question, "Is the female examined a virgin?" is often put to the medical witness, and in few cases should he answer "Yes" or "No."

Apart from the finding of spermatozoa and evidence of disease or injury the answer should be either a description of the state of the hymen or "I found the conditions usual in virginity." "I found conditions usual in females who have had intercourse," or "The conditions found gave no evidence of sexual intercourse, but were such that intercourse may have taken place without leaving any evidence."

If the hymen be thin and fairly tense and the opening small, it is obvious no object as large as a penis can have penetrated.

If, on the other hand, the opening be large or the hymen be thick and elastic, or loose and flaccid, it is impossible to say from a physical examination that no penis has ever penetrated it.

If there be a laceration of the hymen the medical witness should say so, and add whether the laceration be recent or of old standing, *i.e.* its margins raw or cicatrized.

In a recent case where another surgeon had examined the victim he stated in his evidence, "The hymen was completely destroyed." I found a circular hymen with a single linear tear in its posterior quadrant.

The opinions given by medical witnesses are often vague when they might well be definite. They are more often emphatic in circumstances when they should have been expressed with reservation.

IX.

HANKIN'S TEST FOR SEMINAL STAINS.

(Refer, p. 306.)

In the hot dry climate of Upper India, seminal stains occasionally become so altered that it is impossible to remove spermatozoa from the fabric for examination by ordinary methods. It occurred to me that, in such cases, by subjecting the fabric to the solvent action of potassium cyanide, it might be possible to render the spermatozoa capable of removal. It was found that they could not withstand the cyanide unless they had been previously hardened by boiling in a tannin

solution. The following are the details of the process. It must be understood that a less complicated procedure would probably be preferable in a damper climate.

(1) Cut out the suspected stains from the articles of clothing, etc. The cut-out pieces should be about a centimetre square. In the case of dhoties, the chances of success in detection are greatly increased if the supposed seminal stains have been marked by the police at the time of taking off the garment.

(2) Place the cut-out stains in a test-tube, and label the latter.

(3) Add sufficient acid tannin solution to cover the stains. This solution contains tannin 0·5 per cent., and sulphuric acid 0·2 per cent.

(4) Place the test-tube in a small beaker of boiling water. Keep it in the boiling water for exactly five minutes. In timing the different stages of this test, it is convenient to place a watch on the table and to make a mark on its glass with a glass pencil.

(5) Take the stains out of the test-tube. A piece of wire bent at the end to a small hook is convenient for the purpose. If the liquid in the test-tube remains transparent on cooling, it may safely be concluded that the stains are not seminal. If, as is more usually the case, the liquid becomes turbid on cooling, the stains may either be seminal or due to some other kind of organic matter.

(6) Place the stains on a piece of clean filter paper, and gently press them with another piece of filter paper to remove superfluous moisture. Fresh and clean filter paper must always be used. It is not advisable to keep a large piece of blotting paper on the table and to use it for different articles.

(7) Place the stains for half a minute in glycerine ammonia solution. This solution contains glycerine 5 per cent., and strong ammonia solution ¼ per cent. The object of this treatment is to remove or neutralize the excess of tannin solution. If this is not done the stained specimens will contain too much coloured background.

(8) Remove the stains and put them on filter paper.

(9) Transfer the stains to a small glass dish containing acid bichromate solution. Leave them in this solution for five minutes. This solution should contain one per thousand of potassium bichromate and two per thousand of sulphuric acid. This solution does not keep well, especially at a high temperature. Therefore, in the hot weather, it is advisable that it should be freshly made up. The action of the bichromate solution is to make the spermatozoa stain deeply when they are afterwards treated with carbol fuchsin.

(10) Place the stains on filter paper till superfluous liquid drains off.

(11) Transfer the stains to a solution of 2 per cent. potassium cyanide. The action of this solution is to loosen the spermatozoa. If the action continues too long the spermatozoa may be dissolved.

(12) Take out the stains after the lapse of three minutes. Mop off the excess of cyanide solution with blotting paper. Place the stains in a glass dish containing distilled water.

(13) Place each stain separately on a slide. Mop off excess of water. Hold the stained fabric at one end with a pair of forceps, and scrape the surface with a knife. Sufficient water should be left to form a drop in which the scrapings are suspended. This drop is spread out on the slide. This treatment does not readily break up the spermatozoa. If the heads are found separate from the tails, this is because decomposition had commenced before the stain had dried.

(14) The slides, immediately after preparation, are dried preferably in a current of air while lying on the top of a water bath. This rapid drying is convenient but not indispensable.

(15) The films on the slides are fixed by pouring over them a mixture of equal parts of alcohol and ether.

(16) The films are stained by means of carbol fuchsin, which is allowed to act for five minutes at air temperature For this and the preceding stages it is convenient for several slides to be held at the same time in a special clip, so that they can be treated together.[1]

(17) The slides are well washed with water. They are then washed for a few seconds with rectified spirit. The spirit is immediately and rapidly mopped off with filter paper, and the slide is at once dried.

(18) The slides are examined with a medium power lens (*e.g.* 3 millimetres). The spermatozoa should be readily visible, both the heads and the tails being stained, and, as a rule, stained deeply. Particles seen in these specimens have every conceivable shape. With sufficient care, and sufficient use of the imagination, particles may be found in any specimen that have

[1] In staining the slides it is possible that the fingers may become stained with carbol fuchsin. These stains may be removed by the following method. Take two basins, one containing water made alkaline with a few drops of ammonia, and the other containing alcohol. Place the stained fingers in these two basins alternately several times. The period of immersion in each liquid should be from five to ten seconds. After a few dips the colour will be found to have passed out into the watery liquid. Diffusion currents produced when the alcohol-wetted finger is placed in the water probably play a part in removing the dye. The same method may be used in removing carbolic acid from the skin.

some resemblance in outline to spermatozoa. The only safe rule for a beginner is that a positive diagnosis must not be made unless several spermatozoa are found. Spermatozoa are not recognizable as such for medicolegal purposes unless the heads are found in contact with the tails. Owing to decomposition the tails may often be greatly reduced in length, and in many individuals broken off. Really, when not visible with a low power, spermatozoa may be found with the help of an oil immersion lens. But in all cases in which spermatozoa are only found with difficulty there should be great hesitation in making a positive diagnosis.

The great majority of stains that are examined will fail to show spermatozoa. Spermatozoa are not likely to be detected in the following cases: (1) In films in which there is no sign of strongly stained organic matter, for instance, in specimens consisting almost entirely of dust or sand. (2) Spermatozoa are not likely to be found in preparations in which no epithelial scales are seen. (3) Spermatozoa are usually not recognizable if very numerous bacteria are present. Spermatozoa, at temperatures that obtain in India, may readily be rendered unrecognizable by decomposition. Decomposition for twenty-four hours is often more than sufficient to produce this change. In cases of assault coming under Section 376, I.P.C., the man usually runs away, thereby drying the stains on his dhoto, which therefore are protected from decomposition and remain recognizable. The woman's clothes, on the other hand, are liable to be wrapped up and sent for examination before the stains have had a chance of drying. This may be one of the reasons why, in practice, it rarely happens that spermatozoa are detected on a woman's clothes. The chance of detection of spermatozoa would be greatly increased if stains could be dried, at air temperature, as early as possible after their formation.

To search through ten to twenty slides for spermatozoa is somewhat tedious work. In my experience it is best done in the early morning. Later in the day, when the eye is tired, the process of recognition is less rapid and easy.

X.

LUNACY CERTIFICATE—FORMS.

SCHEDULE, INDIAN LUNACY ACT, 1912 (IV. OF 1912).

(*See section* 96.)

FORM 1.

Application for Reception Order.

(*See sections* 5 *and* 6.)

In the matter of A. B.[1], residing at , by occupation , son of ;
a person alleged to be a lunatic.

To Presidency Magistrate, for
[*or* District Magistrate of
, *or* Sub-divisional Magistrate of
or Magistrate specially empowered under Act IV. of 1912 for].

The petition of C. D.[1], residing at , by occupation , son of , in the town of [*or* sub-division of, in the district of].

1. I am [2] years of age.

2. I desire to obtain an order for the reception of A. B. as a lunatic in the asylum of situate at [3].

3. I last saw the said A. B. at on the [4] day of.

4. I am the [5] of the said A. B.

[*or if the petitioner is not a relative of the patient state as follows.*]

I am not a relative of the said A. B. The reasons why this petition is not presented by a relative are as follows: [*State them.*]

The circumstances under which this petition is presented by me are as follows: [*State them.*]

[1] Full name, caste and titles.

[2] Enter the number of completed years. The petitioner must be at least eighteen or twenty-one, whichever is the age of majority under the law to which the petitioner is subject.

[3] Insert full description of the name and locality of the asylum or the name, address, and description of the person in charge of the asylum.

[4] A day within 14 days before the date of the presentation of the petition is requisite.

[5] Here state the relationship with the patient.

5. The persons signing the medical certificate which accompany the petition are [1].

6. A statement of particulars relating to the said A. B. accompanies this petition.

7. [*If that is the fact.*] An application for an inquiry into the mental capacity of the said A. B. was made to the on the and a certified copy of the order made on the said petition is annexed hereto. [*Or if that is the fact.*]

No application for an inquiry into the mental capacity of the said A. B. has been made previous to this application.

The petitioner therefore prays that a reception order may be made in accordance with the foregoing statement.

(Sd.) C. D.

The statements contained or referred to in paragraph are true to my knowledge; the other statements are true to my information and belief.

(Sd.) C. D.

Dated

Statement of particulars.

[*If any of the particulars in this statement is not known, the fact to be so stated.*]

The following is a statement of particulars relating to the said A. B.

Name of patient at length.

Sex and age.

Married, single or widowed.

Previous occupation.

Caste and religious belief, as far as known.

Residence at or immediately previous to the date hereof.

Names of any near relatives to the patient who are alive.

Whether this is first attack of lunacy.

Age (if known) on first attack.

When and where previously under care and treatment as a lunatic.

Duration of existing attack.

Supposed cause.

Whether the patient is subject to epilepsy.

Whether suicidal.

Whether the patient is known to be suffering from phthisis or any form of tubercular disease.

Whether dangerous to others, and in what way.

Whether any near relative (stating the relationship) has been afflicted with insanity.

Whether the patient is addicted to alcohol, or the use of opium, ganja, charas, bhang, cocaine or other intoxicant.

[The statements contained or referred to in paras. are true to my knowledge. The other statements are true to my information and belief.]

[*Signature by person making the statement.*]

[1] Here state whether either of the persons signing the medical certificates is a relative, partner or assistant of the lunatic or of the petitioner and, if a relative of either, the exact relationship.

FORM 3.

Medical Certificate.

(*See sections* 18, 19.)

In the matter of A. B. of [1] in the town of [*or* the sub-division of in the district of] an alleged lunatic.

I. the undersigned C. D., do hereby certify as follows:

1. I am a gazetted medical officer [*or* a medical practitioner declared by Government a holder of [2] [*or* declared by Local Government to be a medical practitioner under Act IV. of 1912] to be medical officer under Act IV. of 1912] and I am in the actual practice of the medical profession.

2. On the day of 19 at [3] in the town/village of [*or* the sub-division of in the district of] [separately from any other practitioner] [4], I personally examined the said A. B. and came to the conclusion that the said A. B. is a lunatic and a proper person to be taken charge of and detained under care and treatment.

3. I formed this conclusion on the following grounds, *viz.*:—

(*a*) Facts indicating insanity observed by myself, *viz.*:—

(*b*) Other facts (if any) indicating insanity communicated to me by others, *viz.*:—*Here state the information and from whom.*

(Sd.) C. D.
(*Designation as above.*)

[1] Insert residence of patient.
[2] Insert qualification to practise medicine and surgery registrable in the United Kingdom.
[3] Insert place of examination.
[4] Omit this where only one certificate is required.

XI.

LIFE ASSURANCE IN INDIA.

In a relatively recent note on "Mortality and Life Assurance in India" read before the Institute of Actuaries in 1909 (*Proc.*, p. 8), Mr. A. T. Winter, F.I.A., writes:

"Amongst European lives, the mortality is nearly as high in the first five years of assurance as in subsequent years," and then again, "during the first few years of residence in India, Europeans are more likely to become victims to enteric fever and similar diseases than subsequently, and as assurances are frequently effected when a man goes out of the country, this period of acclimatization is often concurrent with the first five

years of assurance. This, I think, explains to a large extent the heavy mortality of Europeans during that period." And on page 26, he writes: "The effect of selection on European mortality in India is not apparent, the mortality rates of the first five years of assurance being approximately the same as those ruling for lives of the same age which have been found insured for longer periods. This may, perhaps, be accounted for by the fact that the trying period of acclimatization is frequently concurrent with the first five years of assurance.

"The most eligible class of natives are assurable at the same rates as Europeans in India, provided their age entry does not exceed forty."

Concealments of Material Facts in Life Assurance. (See p. 431.)

Case (1)—J. A. R., insured in 1910, stated in reply to a written question that he never had syphilis. He died suddenly, aged 39, from cerebral hæmorrhage in 1915. It transpired that he had contracted syphilis in 1907 and underwent over a year's treatment. At first the company refused to pay, but subsequently compounded for a small sum.

Case (2)—Norwich Union and G. In 1913 the life of G. was assured for Rs.80,000. A fortnight later he was found impaled on some railings outside the house of a man interested in the Assurance. He had obviously either fallen, jumped, or been thrown out of a second story window. At the autopsy I recognized him as a man who had been examined by me with a view to assurance a month previously. I had rejected him, as I found advanced tuberculosis of the upper lobe of the right lung, a suspicious condition of the left apex, and some suppurating tubercular glands in the neck. I informed him and his friends of his condition, and advised them that it was impossible to get assured in any company. Nevertheless he got assured by the Norwich Union a fortnight later, concealing the fact that he had tuberculosis and stating falsely that he had never been examined previously with a view to assurance. I communicated these facts in writing to the Company, the Coroner and to the Police, and requested the autopsy should be made by an independent pathologist. This pathologist found the conditions I had indicated, but much more advanced in the left lung than I had found a month previously. All claim on the Norwich Union was withdrawn.—Professor A. Powell's *Notes*, 1917.

XII.

POISONING AND ANTIDOTES, SUMMARY.

Diagnosis.—For diagnosis of the particular kind of poison taken the following suggestive list is abstracted from Murrell's admirable handbook "What to do in Cases of Poisoning."

1. **You will find the patient dead.**—Prussic Acid, Cyanide of Potassium, Strong Ammonia, Carbonic Acid Gas,

Carbonic Oxide, Oxalic Acid and other active poisons given in a large dose.

2. **Patient is comatose.**—Opium and Morphine, Alcohol, Chloral, Chloroform, Camphor.

3. **Is collapsed.**—Strong Acids, Alkalis, Aconite, Antimony, Arsenic, Tobacco, Antipyrin, Antifebrin and last stage of most poisons.

4. **Is cyanozed.**—Aniline, Antifebrin.

5. **Is delirious.**—Cannabis Indica, Datura, Belladonna (noisy), Hyoscyami, Alcohol, Camphor.

6. **Is tetanized.**—Nux Vomica and Strychnine, Arsenic, Antimony, excessive pain also approaches this condition.

7. **Is paralysed.**—Aconite, Arsenic, Lead, Conium.

8. **Pupils dilated.**—Datura, Belladonna, and Hyoscyamus, in early stage; Opium and Aconite in last stage, Chloroform, Alcohol.

9. **Pupils contracted.**—Opium, Physostigmine, Chloral.

10. **Skin is dry.**—Datura, Belladonna, Hyoscyamus.

11. **Skin is moist.**—Opium, Aconite, Antimony, Alcohol, Tobacco and other poisons in state of collapse.

12. **Mouth is bleached.**—Carbolic Acid, Corrosive Sublimate and Caustic Acids and Alkalis.

13. **Is vomiting.**—Arsenic (Brown with Blood), Antimony (White), Digitalis (Green), Aconite, Ammonia, Phosphorus, etc.

Antidotes for Commoner Poisons.

Abbreviations.

SP = Stomach pump.
E = Emetic, preferably apomorphine $\frac{1}{10}$ gr., or common salt or mustard at once, followed by bitter emetic, ipecacuanha, zinc sulphate, etc.

D = Demulcents, milk, white of egg, barley water, olive oil, ¼ to 1 of water, flour paste.
St = Stimulants, *e.g.* brandy, ether, sal-volatile, hot water bottles to feet and arms.
UA = Universal antidote.[1]

	Poisons.	Treatment and antidotes.
Acids	Mineral acids, strong	Do not use SP or E, but neutralize by alkalis—*e.g.* chalk, scrapings from whitewashed wall, mortar, soda, soap and water, or UA. Then D. Opium or morphine, ⅓ gr. for pain and shock.
	Oxalic acid ..	Do not use SP or E, but give lime, followed by castor oil.
	Carbolic acid ..	Wash out stomach till washing cease to smell. Then fill stomach with solution sulphate magnesia, ¼ oz. to pint. D and St. Artificial respiration if necessary.
	Hydrocyanic acid and cyanides	In open air, cold douche dashed over head and neck from height. SP or E. Sulphate of iron and liquor perchloride of iron. St and ether hypodermically.
Alkalies	Caustic alkalies ..	Do not use SP or E, but neutralize by dilute acids. vinegar, lime juice. Then D, and, for pain, morphine sulphate ⅓ gr
Metallic salts	Arsenic	SP or E. Complete removal of contents is important. UA, or ferric hydrate, or dialyzed iron, in frequently repeated tablespoonfuls, followed by a little salt in water as emetic. D and St. Ice for thirst. During recovery, morphine ⅓ gr.
	Antimony salts ..	Its own emetic: if not, SP or E. Strong tea or other tannin repeated. D, St, and, for pain, morphine.
	Mercuric chloride	Do not empty stomach till give white of egg mixed with milk and water. Then SP or E to get rid of precipitate. UA. Tincture of opium for pain or purging. St if depression.
	Copper	If no vomiting, egg and milk before emptying stomach. D and opium.
	Lead	SP or E. Sulphates of magnesia or soda, or dilute sulphuric acid. D. Opium or morphine for pain.
	Silver salts ..	Common salt. E to remove silver chloride, and D.

[1] The Universal Antidote of Murrell is (*a*) Saturated solution of Ferrous sulphate 100 parts. (*b*) Calcined Magnesia 88 parts, Charcoal 40, Water 100. Mix these two solutions at the moment of using. Murrell states that it is a perfect antidote for Arsenic, Zinc and Digitalis and Acids, useful for Mercury, Morphine and Strychnine, but of no use for Alkalis, Lead, Antimony or Hydrocyanic Acid.

	Poisons.	Treatment and Antidotes.
Organic Poisons	Opium and morphine	SP, or in mild cases E. Hot coffee. Potassium permanganate (see p. 465) by mouth and for washing stomach, or charcoal. UA, especially for morphine. Rouse and dash cold water on face. Warm extremities. Artificial respiration for some hours, if necessary, and strychnine $\frac{1}{30}$ gr., or liquor 5 mins., and atropine ($\frac{1}{30}$ gr.) hypodermically.
	Aconite	SP or E. Digitalis (20 mins.) or digitalin $\frac{1}{100}$ gr. hypodermically. St and warmth to extremities. Keep recumbent position. Artificial respiration and friction. Strychnine $\frac{1}{60}$ gr.
	Datura	SP or E. Morphine ($\frac{1}{3}$ gr.) or pilocarpine ($\frac{1}{2}$ gr.). St and hot coffee. Artificial respiration.
	Strychnine and nux vomica	SP or E. Potassium bromide 2 drams, UA or tannin 30 grs. iodine tincture $\frac{1}{2}$ dram in water, followed by E or SP. Chloroform inhalation in convulsions. Artificial respiration.
	Digitalis	SP or E. UA, tannin or strong tea or coffee. St and warmth. Recumbent position and aconite.
	Alcohol (acute) ..	Ammonium carbonate 30 grs. in water. SP or E. Rouse by cold affusion, battery, hot coffee. Artificial respiration. Warmth to extremities.
	Chloral and chloroform	SP or E. Strychnine, warmth, friction, and hot coffee. St, ether hypodermically. Artificial respiration.
	Aniline derivatives, antipyrine, antifebrin, phenacetin, pyrogallol	E, St. Warm extremities. Recumbent position. Strychnine $\frac{1}{20}$ gr. Artificial respiration.
	Cocaine	SP, St, and inhale ammonia, amyl nitrite. Morphine. Artificial respiration.
	Croton oil ..	SP or E. Wash out stomach with milk or sweet oil and water. D, St. Opium or morphine for pain.
	Fungi and food, poisonous	SP or E. Purgatives. St any warmth. Opium or morphine for pain.

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